APPLETONS' HOME READING BOOKS

THE ANIMAL WORLD

VINCENT

Appletons' Home Reading Books

EDITED BY

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UNITED STATES COMMISSIONER OF EDUCATION

DIVISION I

NATURAL HISTORY

The Bald Eagle.

APPLETONS' HOME READING BOOKS

THE ANIMAL WORLD

ITS ROMANCES AND REALITIES

A READING-BOOK OF ZOÖLOGY

COMPILED AND EDITED BY
FRANK VINCENT, M. A.
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INTRODUCTION TO THE HOME READING BOOK SERIES BY THE EDITOR.

THE new education takes two important directions—one of these is toward original observation, requiring the pupil to test and verify what is taught him at school by his own experiments. The information that he learns from books or hears from his teacher's lips must be assimilated by incorporating it with his own experience.

The other direction pointed out by the new education is systematic home reading. It forms a part of school extension of all kinds. The so-called "University Extension" that originated at Cambridge and Oxford has as its chief feature the aid of home reading by lectures and round-table discussions, led or conducted by experts who also lay out the course of reading. The Chautauquan movement in this country prescribes a series of excellent books and furnishes for a goodly number of its readers annual courses of lectures. The teachers' reading circles that exist in many States prescribe the books to be read, and publish some analysis, commentary, or catechism to aid the members.

Home reading, it seems, furnishes the essential basis of this great movement to extend education

beyond the school and to make self-culture a habit of life.

Looking more carefully at the difference between the two directions of the new education we can see what each accomplishes. There is first an effort to train the original powers of the individual and make him self-active, quick at observation, and free in his thinking. Next, the new education endeavors, by the reading of books and the study of the wisdom of the race, to make the child or youth a participator in the results of experience of all mankind.

These two movements may be made antagonistic by poor teaching. The book knowledge, containing as it does the precious lesson of human experience, may be so taught as to bring with it only dead rules of conduct, only dead scraps of information, and no stimulant to original thinking. Its contents may be memorized without being understood. On the other hand, the self-activity of the child may be stimulated at the expense of his social well-being—his originality may be cultivated at the expense of his rationality. If he is taught persistently to have his own way, to trust only his own senses, to cling to his own opinions heedless of the experience of his fellows, he is preparing for an unsuccessful, misanthropic career, and is likely enough to end his life in a madhouse.

It is admitted that a too exclusive study of the knowledge found in books, the knowledge which is aggregated from the experience and thought of other people, may result in loading the mind of the pupil with material which he can not use to advantage.

Some minds are so full of lumber that there is no space left to set up a workshop. The necessity of uniting both of these directions of intellectual activity in the schools is therefore obvious, but we must not, in this place, fall into the error of supposing that it is the oral instruction in school and the personal influence of the teacher alone that excites the pupil to activity. Book instruction is not always dry and theoretical. The very persons who declaim against the book, and praise in such strong terms the self-activity of the pupil and original research, are mostly persons who have received their practical impulse from reading the writings of educational reformers. Very few persons have received an impulse from personal contact with inspiring teachers compared with the number that have received an impulse from such books as Herbert Spencer's Treatise on Education, Rousseau's Émile, Pestalozzi's Leonard and Gertrude, Francis W. Parker's Talks about Teaching, G. Stanley Hall's Pedagogical Seminary. Think in this connection, too, of the impulse to observation in natural science produced by such books as those of Hugh Miller, Faraday, Tyndall, Huxley, Agassiz, and Darwin.

The new scientific book is different from the old. The old style book of science gave dead results where the new one gives not only the results, but a minute account of the method employed in reaching those results. An insight into the method employed in discovery trains the reader into a naturalist, an historian, a sociologist. The books of the writers above named have done more to stimulate original research on the

part of their readers than all other influences combined.

It is therefore much more a matter of importance to get the right kind of book than to get a living teacher. The book which teaches results, and at the same time gives in an intelligible manner the steps of discovery and the methods employed, is a book which will stimulate the student to repeat the experiments described and get beyond these into fields of original research himself. Every one remembers the published lectures of Faraday on chemistry, which exercised a wide influence in changing the style of books on natural science, causing them to deal with method more than results, and thus to train the reader's power of conducting original research. Robinson Crusoe for nearly two hundred years has stimulated adventure and prompted young men to resort to the border lands of civilization. A library of home reading should contain books that stimulate to self-activity and arouse the spirit of inquiry. The books should treat of methods of discovery and evolution. All nature is unified by the discovery of the law of evolution. Each and every being in the world is now explained by the process of development to which it belongs. Every fact now throws light on all the others by illustrating the process of growth in which each has its end and aim.

The Home Reading Books are to be classed as follows:

First Division. Natural history, including popular scientific treatises on plants and animals, and also de-

scriptions of geographical localities. The branch of study in the district school course which corresponds to this is geography. Travels and sojourns in distant lands; special writings which treat of this or that animal or plant, or family of animals or plants; anything that relates to organic nature or to meteorology, or descriptive astronomy may be placed in this class.

Second Division. Whatever relates to physics or natural philosophy, to the statics or dynamics of air or water or light or electricity, or to the properties of matter; whatever relates to chemistry, either organic or inorganic—books on these subjects belong to the class that relates to what is inorganic. Even the so-called organic chemistry relates to the analysis of organic bodies into their inorganic compounds.

Third Division. History and biography and ethnology. Books relating to the lives of individuals, and especially to the social life of the nation, and to the collisions of nations in war, as well as to the aid that one gives to another through commerce in times of peace; books on ethnology relating to the manners and customs of savage or civilized peoples; books on the primitive manners and customs which belong to the earliest human beings—books on these subjects belong to the third class, relating particularly to the human will, not merely the individual will but the social will, the will of the tribe or nation; and to this third class belong also books on ethics and morals, and on forms of government and laws, and what is included under the term civics or the duties of citizenship.

Fourth Division. The fourth class of books includes more especially literature and works that make known the beautiful in such departments as sculpture, painting, architecture and music. Literature and art show human nature in the form of feelings, emotions, and aspirations, and they show how these feelings lead over to deeds and to clear thoughts. This department of books is perhaps more important than any other in our home reading, inasmuch as it teaches a knowledge of human nature and enables us to understand the motives that lead our fellow-men to action.

To each book is added an analysis in order to aid the reader in separating the essential points from the unessential, and give each its proper share of attention.

W. T. Harris.

Washington, D. C., *November 16, 1896.*

PREFACE.

THE warm public favor shown "The Plant World: its Romances and Realities. A Reading-Book of Botany" has encouraged me to prepare a companion volume in zoölogy.

As with the former, the subject has been approached from as many conspicuous and characteristic points as possible. The selections, moreover, being entertaining as well as instructive, are designed to awaken the curiosity of readers and stimulate them to independent observation and investigation. Appropriate extracts of verse have been introduced for variety's sake, and especial care has been taken that the illustrations shall be attractive and impressive.

Each selection having been accredited to its author (when known) and the work whence borrowed, no further acknowledgment is thought necessary here.

F. V.

NEW YORK, *January, 1898.*

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ILLUSTRATIONS.

THE ANIMAL WORLD.

TO THE CUCKOO.

1. O BLITHE new-comer! I have heard,
   I hear thee and rejoice.
   O cuckoo! shall I call thee bird,
   Or but a wandering voice?

2. While I am lying on the grass
   Thy two-fold shout I hear;
   From hill to hill it seems to pass,
   At once far off and near.

3. Though babbling only to the vale
   Of sunshine and of flowers,
   Thou bringest unto me a tale
   Of visionary hours.

4. Thrice welcome, darling of the spring!
   Even yet thou art to me
   No bird, but an invisible thing,
   A voice, a mystery;

5. The same whom in my school-boy days
I listened to; that cry
Which made me look a thousand ways,
In bush and tree and sky.

6. To seek thee did I often rove
Through woods and on the green;
And thou wert still a hope, a love;
Still longed for, never seen.

7. And I can listen to thee yet;
Can lie upon the plain
And listen, till I do beget
That golden time again.

8. O blessèd bird! the earth we pace
Again appears to be
An unsubstantial, fairy place;
That is fit home for thee!

WORDSWORTH.

SPIDERS.

1. INCAPABLE of muscular exertion, and of a texture so loose and soft as to be torn to pieces or crushed by the slightest degree of force, the spiders seem exposed to every attack; and yet, helpless and harmless as they appear to be, they are able to subdue animals much larger than themselves; for as a compensation for their weakness, they are endowed

A Camel Caravan, Algerian Sahara.

with a most admirable industry, an exemplary patience, an indomitable perseverance, and the power of secreting two liquids which fully answer all the purposes of offense or defense which their mode of life requires. One of these liquids is a poison which at once paralyzes the resistance of their prey, and acts with the same instantaneous and fatal effect upon a fly or a beetle as prussic acid on the human economy; the other, a glutinous fluid, which, concreting in the air, forms those silken threads which their wonderful instinct turns to so many valuable uses.

2. The structure of the venomous apparatus of the viper is justly admired, but that of the spider is a no less beautiful piece of mechanism. It is by means of the two *mandibulæ* or forcipals with which their mouth is armed, that they inflict their deadly wound. These mandibles are each armed with a movable and extremely sharp claw, near to the point of which is a minute orifice, from which there escapes a drop of poisonous liquid, that spreads itself over the whole wound the instant that it is inflicted. This orifice, which is so extremely minute as to require a high magnifying power for its perception, communicates with a fine or narrow excretory canal situated in the interior of the mandible, and given off from the true secreting organ—a gland lodged in the interspace of the muscles of the thorax, or breast, whose compression causes the immediate propulsion of the liquid.

3. A still more wonderful apparatus is that which serves the spiders for the formation of their threads. The spinnerets, or organs which emit the glutinous fluid, are generally six in number, and situated at the

posterior part of the body. Each of the spinnerets is pierced by an infinite number of small holes, or beset with hairy appendages terminating in fine-drawn points, from each of which there escape as many little drops of a liquid, which becoming dry the moment it is in contact with the air, forms so many delicate threads. Immediately after the filaments have passed out of the pores of the spinneret, they unite first together and then with those of the neighboring spinnerets to form a common thread; so that the thread of the spider, which measures only 1-4000th or even 1-8000th of an inch in diameter, is composed of an immense number of minute filaments, perhaps several thousand, of such extreme tenuity that the eye cannot detect them until they are all twisted together into the working thread.

4. But why this complicated process, it may be asked; why this original excessive subdivision of a filament, which, when complete, far surpasses in fineness the finest thread which can possibly be spun by machinery proceeding from human hands? The reason is obvious, for it was absolutely necessary that as soon as the glutinous fluid emerged from the body, it should instantly consolidate into a thread firm enough to be worked or not to give way too suddenly under the spider's weight; and it is evident that by its extreme division, so beautifully provided for by the microscopical perforation of the sievelike spinnerets, the process of desiccation having a larger surface to act upon, must be considerably hastened. Thus there is nothing superfluous in this wonderful mechanism, which, perfect in design and in every de-

tail, could only have been planned and formed by the power and wisdom of God!

5. On examining the uses to which the spiders put their admirable spinning organs, we shall find in every case the workman worthy of his tools. When a house or common spider is about to form a web, it first selects some commodious and secure spot, where insects appear to be in sufficient abundance. It then distills a small drop of its glutinous liquid, and creeping up the wall and spinning its thread as it proceeds, darts itself in a very surprising manner to the opposite station, where the other end of the web is to be fastened. The first thread thus spun, drawn tight and fixed at each end, the spider runs on it to and fro, still assiduously employed in doubling and strengthening it, as on its force the stability of the whole fabric depends. The scaffolding being thus completed, the spider draws a number of threads parallel to and within the first in the same manner, and then crosses them with others, the adhesive substance of which they are formed serving to bind them together when newly spun.

6. This operation being completed, the industrious little architect doubles and trebles the thread that borders its web by opening all its *papillæ* at once, and so secures the edges as to prevent the wind from displacing the work. The edges being thus fortified, the retreat is next to be attended to; and this is formed like a funnel, where the little workman lies concealed. To this there are two passages or outlets, one above and the other below, very artfully contrived to allow the animal an opportunity

of making excursions in every direction. Frequently, also, from the main web, there are several threads extended at some distance on each side, like the cordage of a ship; this may be considered as the outworks of the fortification, which whenever touched from without, instantly communicate the intelligence by the vibration of the net, and bid the lurking spider prepare for attack or self-defense. If the insect impinging happens to be a fly, the concealed assassin instantly springs forward to pierce it with his murderous mandibles; but if, on the contrary, he perceives an enemy stronger than himself, he then, considering discretion to be the better part of valor, keeps quietly within his fortress, and never stirs till the storm is blown over. If the web has been destroyed, the spider is able to renew it twice or thrice from its glutinous stores; but after that its supplies are exhausted, and then it must either die of hunger, or conquer another net, after having defeated the rightful owner in mortal combat; or endeavor to find an empty web, which is not so very difficult, as the young spiders construct two nests.

7. The Garden Spider, which suspends its vertical or oblique web in open space, works in a different manner. It spins a large quantity of thread, which floating in the air in various directions, happens from its glutinous quality at last to adhere to some object near it—a wall or the branch of a tree. The spider is anxious to have one end of the line fixed, that it may be enabled to secure and tighten the other; it accordingly draws the line when thus fixed, and then by passing or repassing it, strengthens the thread in

such a manner as to answer all its intentions. The first cord being thus stretched, the spider walks along a part of it and there fastens another; and dropping from thence, affixes the thread to some solid body below; then climbs up again and begins a third, which it fastens by a similar contrivance. Within this framework, which unites strength and elasticity in a remarkable degree, and though yielding to the slightest pressure immediately recovers its position, the spider now begins to spin its beautiful network, composed of a number of straight lines radiating from a common center, and having a spiral line wound regularly upon them.

8. The radiating lines are smooth, whereas the spiral line is thickly studded with minute knobs, to which the efficacy of the net is due, for they are composed of a thick adhesive and viscid substance, and serve to arrest the wings and legs of the insects that happen to touch the net. It has been observed that these viscid threads are of uniform thickness when first spun, but that undulations soon appear in them, and that the viscid matter soon accumulates in globules at regular intervals. As the spinnerets of the garden-spider are of a different anatomical structure —one pair presenting on its surface a number of small perforations, the edges of which do not project, and which therefore resemble a sieve, while the other is studded with hollow tubes perforated at the extremity —there is reason to suppose that each kind of thread is produced by its own pair of spinnerets.

9. Another point in the construction of these webs, so exactly true in all their proportions, is that

they are executed entirely by the sense of touch. The eyes are situated on the front of the body and on the upper surface, whereas the spinnerets are placed at the very extremity of the body on the under-surface, the threads being always guided by one of the hind-legs, as may be seen by watching a garden-spider in the act of building or repairing her web. To place the fact beyond a doubt, spiders have been confined in total darkness, and yet have spun webs as perfect as if they had been suspended in the open daylight.

10. All spiders require patience, for they have often a long time to wait before they entrap their prey, and even the garden-spiders are subject to long privations, in spite of their consummate skill. Continual stormy weather destroys their nests, and frequently prevents their making a new one for many a day; so that during the protracted period of involuntary fasting, not even a gnat can be caught to satisfy their hunger. And when at length the new net is suspended, a colossal wasp or huge bee comes flying against it, and tears a prodigious breach in its delicate texture. But the philosophic spider bears all the buffetings of adverse fortune with exemplary patience, and instead of breaking out into useless complaints, immediately sets to work, and in a short time the damage is fully repaired.

11. Besides the netmaking spider, there are many others that are satisfied with less artificial snares for entrapping their prey. Some draw their threads over the surface of a leaf, and thus catch the insects that heedlessly wander over the treacherous ground;

others spin them under stones or in the fissures of the soil. In hollow walls, in the crevices of windows, the ferocious *Segestria* conceals her body in a cylindrical tube, open at both ends, from which only her forefeet project, ready to rush upon her prey. She weaves no web, but merely draws a few threads about the hole in which she has fixed her abode. As soon as an unwary fly touches one of them, she immediately pounces upon it and seals its doom. Even wasps, which other spiders are averse from attacking, either on account of their sting or of the hardness of their integuments, are fearlessly encountered and defeated by this formidable spider; for its breast and feet are very hard, and the abdomen is covered with a thick skin, so that it does not fear their sting, and its strong and hard mandibles are able to crush their horny coverings. So beautifully is the organization of the spiders modified, according to the various prey which has been destined for their use!

12. The *Salticus scenicus*, a common black-and-white spider, which may always be seen in summer upon walls and windows, disdains the use of any snare, and, like the tiger, relies upon his spring alone for the overpowering of his prey. When he spies a fly at a distance, he approaches softly step by step, and seems to measure his distance from it by the eye; then if he judges that it is within reach, first fixing a thread to the spot on which he is stationed by means of his forefeet, which are much larger and longer than the others, he darts on his victim with such rapidity and so true an aim, that he seldom misses it. He is prevented from falling by the thread just mentioned,

which acts as a kind of anchor, and enables him to recover his station.

G. HARTWIG, "Harmonies of Nature."

THE WHALE.

1. BY far the largest known inhabitant of the ocean world is the whale, which, on account of its fish-like shape, is usually thought of as belonging to the fish creation. But the whale (including under this name the baleen, or right whale, the sperm whale, and the dolphin family, which covers the porpoise, grampus, and narwhal) is a carnivorous mammal, which has warm blood, and brings forth and suckles its young as much as the cow or the sheep. The right and the sperm whale both attain an enormous size, a length of seventy-five feet being by no means uncommon.

2. Before the discovery of mineral oil, the whale fisheries were so actively carried on from England and America that the extirpation of this great creature was threatened. About the year 1854 there were nearly seven hundred vessels which plowed the seas in every direction, from the frozen zones to the warm waters of the Pacific, engaged in hunting this huge game, and the product of a single year reached nearly half a million barrels of oil. Now that the demand for whale oil has so far decreased, the whale, which is far less hunted, has increased again and will probably soon reach its former standard of numbers.

3. The head of the whale constitutes about one third of its length, and it is from this part that the blubber is extracted. The mouth is of enormous width, and the jaws are armed with plates of whalebone, as in the case of the right whale, or with sharp conical teeth, as in the case of the sperm whale, which is mostly found in the tropical or semi-tropical waters of the Pacific. The presence of the whale is generally made known, even when the animal is under water, by the blowing of huge jets of water in the air. This is caused by the expulsion of the volume of water, which the whale takes in in swallowing its food, through the blow-holes in the top of the head, and has nothing to do with the proper function of breathing, as has been sometimes supposed. It is from the baleen, or right whale, mostly found in the Arctic and Antarctic regions, that the whalebone is derived; this network of elastic material acting as a strainer for its food, which consists of small swimming mollusks and fish. Though the cavity of the mouth is large enough to take in a ship's longboat, the gullet is not larger than a man's fist, and cannot pass anything much larger than a herring. The Greenland whale, which is the largest of the baleens, has a tail about six feet long and twenty-five feet wide. This is the animal's weapon, and it is used with terrible effect, frequently crushing a whaleboat like an eggshell. This whale swims ordinarily just below the surface at the speed of about five miles an hour, though capable of far greater velocity. Often they throw themselves entirely out of water in sport, and one of their playful tricks is to immerse the body perpendicularly, flapping

the tail on the water and making a noise perceptible for several miles.

4. The animal can remain in the ocean depths for half an hour, and when it comes to the surface it stays several minutes blowing off the water. This is the time utilized by the whale hunters, whose knowledge of the creature's habits enables them to calculate the time and place of its appearance very closely. All whales show an extreme tenderness for their young, and during nursing roll gently from side to side, so that each of the offspring may have time to breathe. The southern variety of the right whale does not quite reach the size of its Arctic cousin.

5. In the sperm whale we find, instead of the whalebone plates, a large number of sharp conical teeth in the lower jaw which fit into cavities in the upper jaw. The spermaceti, which is the most valuable find of the whale-fisher, is an oily fluid contained in the enormous head, and on exposure to the air it instantly hardens. In addition to the spermaceti, and the oil, which often amounts to eighty barrels in a single take, this whale yields the ambergris, a peculiar product of the bowels, which is in so much demand by the perfumers.

6. The sperm-whale fishery is far more dangerous than that of the right whale. The sperm whale is not only armed with an enormous tail, the stroke of which has the force of a Nasmyth hammer, but its formidable jaws are supplied with sharp teeth, with which it literally chews a boat into splinters. A whole shoal will sometimes come to the rescue of a wounded companion, and then woe betide the unlucky

whalemen in such an unequal fight, for flight is useless before the rush of these enraged monsters of the deep. The accidents of the sperm-whale fishery furnish a gloomy record, and there are well-authenticated cases of ships having sprung a leak and suffered wreck from the headlong charge of the sperm whale against their sides.

7. The sperm-whale is distributed through all the seas, but its home is principally in the South Pacific. Schools of them, consisting of from twenty to fifty females and their young, with one or two old males or bulls, are common. The males during the time of breeding fight savagely, as their broken and distorted jaws frequently testify. They find their choicest food in the huge squids which abound in the southern seas, and bite off the head as the choice morsel. They also attack large sharks without fear, and by their courage as well as their vast size justify their right to be called the kings of the ocean. In the times when whale-fishing was such an important industry, only the largest and most heavily manned ships were sent in pursuit of the sperm whale, for its capture was justly recognized as the most dangerous and difficult of seafaring trades, as indeed it was also the most remunerative. Whale-fishing has been so often described that it is scarcely worth while to repeat the familiar story, except very briefly.

8. Instantly the lookout sings "There she blows!" the crews rush to the boats, which are promptly lowered, each man taking his place with the regularity of machinery. The boat-steerer, who is also the harpooner, sits in the stern with his trusty

weapon in hand, the fathoms of line attached to it coiled away in a tub at his feet. On approaching the whale he rises, and, seizing the coil in his left, hurls the harpoon with his right hand at the most vulnerable part of the huge animal. Away the line goes like lightning as the stricken whale dives into the depths, and so swift is the paying out of it that water has to be poured on to keep it from setting the boat on fire. More than once a sailor's leg, caught in the whizzing coil, has been cut off as with a cleaver.

9. When the whale rises again, comes the time of special danger. The harpooner again hurls the sharp steel, and the infuriated whale, with blows of the terrible tail or snaps of the no less terrible jaws, seeks to destroy its human foes. Unless the order "Stern all!" is instantly obeyed by backing the boat out of near vicinity when the harpooner makes his throw, the crew find themselves in the water, some of them perhaps crushed or mangled to death. Oftentimes the whale descends several hundred fathoms, and remains under water half an hour. The signal of victory is when the huge creature begins to spout great jets of blood or bloody foam. The whaleman then knows that the death agony is not far off, and puts an end to the struggle by a thrust of the keen, slender lance in a vital part. In addition to harpoon and lance, the harpoon-gun is sometimes employed, this weapon being used from a greater distance. There is still another weapon, more deadly than the others, the bomb-gun. The projectile in this case is so contrived that it explodes inside the doomed whale. A few seconds after it is discharged, a dull, rumbling

sound is heard, the whale makes a convulsive somersault, oftentimes entirely out of the water, and frequently dies almost instantaneously. The whale is often lost to its captors by sinking in its last agonies. If not, the body is towed to the side of the ship, and the disgusting work of butchering the animal, cutting out its blubber, and trying out the oil begins. One whale is generally thus disposed of before another attack is made, though there may be large numbers in daily view.

ANONYMOUS, "A World of Wonders."

STRANGE ANIMAL FRIENDSHIPS.

1. WHY married folk, so ill-mated as to agree only to differ, should be said to lead a cat-and-dog life, is not very clear, since those household pets, being intelligent, affectionate, cheerful, and sociable creatures, very frequently contrive to live harmoniously enough together. The Aston Hall cat, that ate, associated, and slept, with a huge bloodhound, only did what innumerable cats have done. Such companionships are too common to be reckoned among strange animal-friendships, such as that most singular instance of attachment between two animals of opposite natures and habits, related to Mr. Jesse by a person on whose veracity he could depend. The narrator boasted of the proprietorship of an alligator which had become so tame that it would follow him up and down stairs;

while it was so fond of his cat's society that, when she lay down before the fire, the alligator followed suit, made a pillow of puss, and went off to sleep; and when awake the reptile was only happy so long as puss was somewhere near, turning morose and ill-tempered whenever she left it to its own devices.

2. Many equine celebrities have delighted in feline companions, following in this the example of their notable ancestor, the Godolphin Arab, between whom and a black cat an intimate friendship existed for years, a friendship that came to a touching end; for, when that famous steed died, his old companion would not leave the body, and, when it had seen it put underground, crawled slowly away to a hayloft, and, refusing to be comforted, pined away and died.

3. One of Miss Braddon's heroines says: "It is so nice to see a favorite horse looking over the door of his loose-box, with a big tabby-cat sitting on the window-ledge beside him." The big tabby would probably prefer being on horseback, for puss takes very kindly to the stable, and the horse takes as kindly to puss. A cat belonging to the royal stables at Windsor made herself so agreeable to one of the horses there that, rather than put her to any inconvenience, he would take his night's rest standing. This was held detrimental to his health, and the stable authorities, unable to hit upon any other plan, banished poor pussy to a distant part of the country.

4. Mr. Huntington, of East Bloomfield, New York, owns a thorough-bred horse named Narragansett and a white cat. The latter was wont to pay a daily visit to Narragansett's stall, to hunt up the mice

and then enjoy a quiet nap. Mr. Huntington removed to Rochester with his family, leaving the cat behind; but she complained so loudly and so unceasingly that she was sent on to the new abode. Her first object was now to get somebody to interpret her desires. At last her master divined them, and started off with her to the barn. As soon as they were inside, the cat went to the horse's stall, made a bed near his head, and curled herself up contentedly. When Mr. Huntington visited the pair next morning, there was puss close to Narragansett's feet, with a family of five beside her. The horse evidently knew all about it, and that it behooved him to take heed how he moved his feet. Puss afterward would go out, leaving her little ones to the care of her friend, who would every now and then look to see how they were getting on. When these inspections took place in the mother's presence, she was not at all uneasy, although she showed the greatest fear and anxiety if any children or strangers intruded upon her privacy.

5. A gentleman in Sussex had a cat which showed the greatest affection for a young blackbird, which was given to her by a stable-boy for food a day or two after she had been deprived of her kittens. She tended it with the greatest care; they became inseparable companions, and no mother could show a greater fondness for her offspring than she did for the bird.

6. Lemmery shut up a cat and several mice together in a cage. The mice in time got to be very friendly, and plucked and nibbled at their feline friend. When any of them grew troublesome, she

would gently box their ears.—A German magazine tells of a Mr. Hecart who placed a tame sparrow under the protection of a wild-cat. Another cat attacked the sparrow, which was at the most critical moment rescued by its protector. During the sparrow's subsequent illness its natural foe watched over it with great tenderness.—The same authority gives an instance of a cat trained, like a watch-dog, to keep guard over a yard containing a hare, and some sparrows, blackbirds, and partridges.

7. A pair of carriage-horses taken to water at a stone trough, then standing at one end of the Manchester Exchange, were followed by a dog who was in the habit of lying in the stall of one of them. As he gamboled on in front, the creature was suddenly attacked by a mastiff far too strong for his power of resistance, and it would have gone hard with him but for the unlooked-for intervention of his stable-companion, which, breaking loose from the man who was leading it, made for the battling dogs, and with one well-delivered kick sent the mastiff into a cooper's cellar, and then quietly returned to the trough and finished his drink. In very sensible fashion, too, did Mrs. Bland's half-Danish dog Traveler show his affection for his mistress's pet pony. The latter had been badly hurt, and, when well enough to be turned into a field, was visited there by its fair owner and regaled with carrots and other delicacies; Traveler, for his part, never failing to fetch one or two windfall apples from the garden, laying them on the grass before the pony, and hailing its enjoyment of them with the liveliest demonstrations of delight.

8. That such relations should exist between the horse and the dog seems natural enough; but that a horse should be hail-fellow with a hen appears too absurd to be true; yet we have Gilbert White's word for it that a horse, lacking more suitable companions, struck up a great friendship with a hen, and displayed immense gratification when she rubbed against his legs and clucked a greeting, while he moved about with the greatest caution lest he might trample on his "little, little friend."

9. Colonel Montague tells of a pointer which, after being well beaten for killing a Chinese goose, was further punished by having the murdered bird tied to his neck—a penance that entailed his being constantly attended by the defunct's relict. Whether he satisfied her that he repented the cruel deed is more than we know; but, after a little while the pointer and the goose were on the best of terms, living under the same roof, feeding out of one trough, occupying the same straw bed; and, when the dog went on duty in the field, the goose filled the air with her lamentations for his absence.

10. A New Zealand paper says: "There is a dog at Taupo and also a young pig, and these two afford a curious example of animal sagacity and confidence in the *bona fides* of each other. These two animals live at the native 'pah' on the opposite side of Tapuaeharuru, and the dog discovered some happy hunting-grounds on the other side, and informed the pig. The pig, being only two months old, informed the dog that he could not swim across the river, which at that spot debouches from the lake, but that in time he

hoped to share the adventures of his canine friend. The dog settled the difficulty. He went into the river, standing up to his neck in water, and crouched down; the pig got on his back, clasping his neck with his forelegs. The dog then swam across, thus carrying his chum over. Regularly every morning the two would in this way go across and forage around Tapuaeharuru, returning to the pah at night; and, if the dog was ready to go home before the pig, he would wait till his friend came down to be ferried over. The truth of this story is vouched for by several who have watched the movements of the pair for some weeks past."

11. When Cowper cautiously introduced Puss—a hare that had never seen a spaniel—to Marquis—a spaniel that had never seen a hare—he discovered no token of fear in the one, no sign of hostility in the other, and the new acquaintances were soon in all respects sociable and friendly—a proof, the poet thought, that there was no natural antipathy between dog and hare. Upon just as good grounds the same might be inferred regarding dog and fox. We have read of a tame fox hunting with a pack of harriers; and Mr. Moffat, of Bearsley, Northumberland, owned one that was excessively fond of canine society. In consequence of detection following a raid on the poultry-yard, Master Reynard was chained up in a grass area. Whenever he caught sight of a dog coming his way, he began fanning his tail, and, laying back his ears, would strain desperately at the full length of his tether, that he might smell at the mouth of the dog, and use all his arts to induce him to have a romp, even

though he had never set eyes on that especial dog before.

12. In 1822 some white rats were trapped in Colonel Berkeley's stables. Mr. Samuel Moss, of Cheltenham, took a fancy to a youngster, and determined to make a pet of him. He was soon tamed, and christened Scugg. Then he was formally introduced to a rat-killing terrier, a ceremony so well understood by Flora that she not only refrained from assaulting the new-comer, but actually constituted herself his protectress, mounting guard over Scugg whenever a stranger came into the room, growling, snarling, and showing her teeth, until convinced he had no evil intentions toward her *protégé*. These two strangely-assorted friends lapped from the same saucer, played together in the garden, and, when Flora indulged in a snooze on the rug, Scugg ensconced himself snugly between her legs. He would mount the dinner-table and carry off sugar, pastry, or cheese, while Flora waited below to share in the plunder. One day a man brought Mr. Moss another white rat, while the terrier and Scugg were racing about the room. The stranger was shaken out of the trap, and presently two white rats were scampering across the floor pursued by Flora. The chase did not last long, one of them quickly falling a victim to the terrier's teeth, much to the experimentalist's alarm, as his eyes could not distinguish one rat from the other. Looking around, however, his mind was relieved, for there in his corner was Scugg, with Flora standing sentry before him—a position she held until the man and the dead rat were out of the room.

When his master took a wife to himself, a new home was found for Scugg; but the poor fellow died within a month of his removal, and it is not improbable that the separation from his canine friend was the primary cause of the rat's untimely decease.

13. St. Pierre pronounced the mutual attachment displayed between a lion at Versailles and a dog to be one of the most touching exhibitions Nature could offer to the speculations of the philosopher. Such exhibitions are by no means rare. Captive lords of the forest and jungle have often admitted dogs to their society and lived on affectionate terms with them. Not long ago, an ailing lioness in the Dublin Zoölogical Gardens was so tormented by the rats nibbling her toes that a little terrier was introduced into the cage. His entrance elicited a sulky growl from the invalid; but, seeing the visitor toss a rat in the air and catch it with a killing snap as it came down, she at once came to the sensible conclusion that the dog's acquaintance was worth cultivating. Coaxing the terrier to her side, she folded her paw round him and took him to her breast; and there he rested every night afterward, ready to pounce upon any rat daring to disturb the slumbers of the lioness.

14. The last time we visited the lion-house of the Regent's Park Zoölogical Gardens, we watched with no little amusement the antics of a dog, who was evidently quite at home in a cage occupied by a tiger and tigress. The noble pair of beasts were reclining side by side, the tiger's tail hanging over the side of their couch. The dog, unable to resist the temptation, laid hold of it with his teeth and pulled with a

will; and, spite of sundry gentle remonstrances on the part of the owner of the tail, persisted until he elicited a very deep growl of disapproval. Then he let go, sprang upon the tiger's back, curled himself up, and went to sleep. Such friendships are, it must be owned, liable to come to a tragic ending, like that recorded by an ancient writer, who tells how a lion, a dog, and a bear, lived together for a long time on the most affectionate terms, until the dog, accidentally putting the bear out of temper, had the life put out of his body; whereupon Leo, enraged at losing his favorite, set upon Bruin and made an end of him too.

ANONYMOUS, "Chambers's Journal."

TO THE HUMBLEBEE.

1. BURLY, dozing humblebee!
Where thou art is clime for me;
Let them sail for Porto Rique,
Far-off heats through seas to seek,
I will follow thee alone,
Thou animated torrid zone!
Zigzag steerer, desert cheerer,
Let me chase thy waving lines;
Keep me nearer, me thy hearer,
Singing over shrubs and vines.

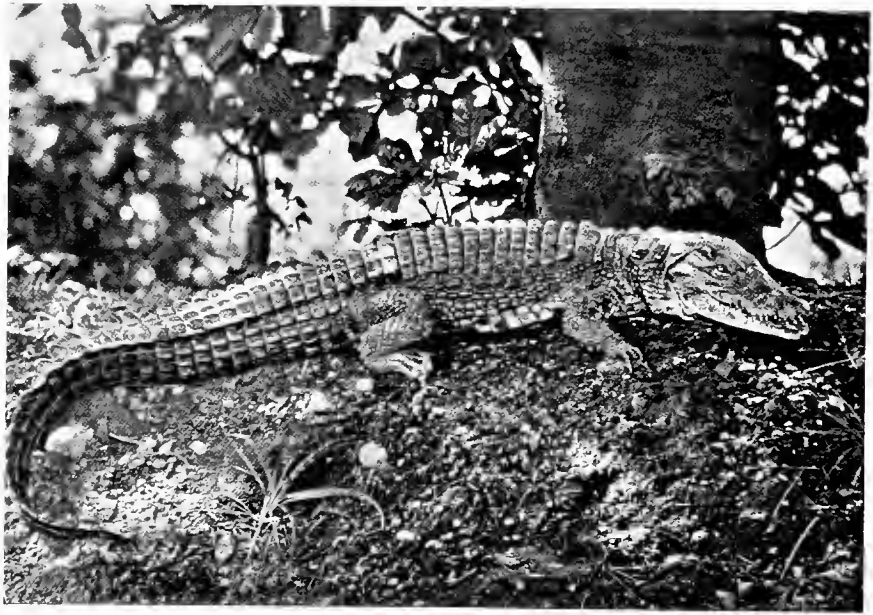
2. Insect lover of the sun,
Joy of thy dominion!

Sailor of the atmosphere;
Swimmer through the waves of air,
Voyager of light and noon,
Epicurean of June!
Wait, I prithee, till I come
Within earshot of thy hum,—
All without is martyrdom.

3. When the south-wind, in May days,
With a net of shining haze
Silvers the horizon wall;
And, with softness touching all,
Tints the human countenance
With the color of romance;
And infusing subtle heats
Turns the sod to violets,—
Thou in sunny solitudes,
Rover of the underwoods,
The green silence dost displace
With thy mellow breezy bass.

4. Hot midsummer's petted crone,
Sweet to me thy drowsy tone
Tells of countless sunny hours,
Long days, and solid banks of flowers;
Of gulfs of sweetness without bound,
In Indian wildernesses found;
Of Syrian peace, immortal leisure,
Firmest cheer, and birdlike pleasure.

5. Aught unsavory or unclean
Hath my insect never seen;



An African Crocodile.

But violets, and bilberry bells,
Maple sap, and daffodels,
Grass with green flag half-mast high,
Succory to match the sky,
Columbine with horn of honey,
Scented fern, and agrimony,
Clover, catchfly, adder's-tongue,
And brier-roses, dwelt among:
All beside was unknown waste,
All was picture as he passed.
Wiser far than human seer,
Yellow-breeched philosopher,
Seeing only what is fair,
  Sipping only what is sweet,
Thou dost mock at fate and care,
  Leave the chaff and take the wheat.
When the fierce northwestern blast
Cools sea and land so far and fast,—
Thou already slumberest deep;
Woe and want thou canst outsleep;
Want and woe, which torture us,
Thy sleep makes ridiculous.

EMERSON.

THE AMPHIBIANS.

1. THOSE geographers who divide the world into land and sea overlook in their nomenclature the extensive geographical areas which belong permanently to neither section—namely, the vast marshy regions

on the margins of lakes, rivers, and ponds, which are alternately deluged with the overflow of the adjacent waters, or are parched from the exhalations produced by summer heat; regions which could only be inhabited by beings capable of living on land or in water —beings having both gills (through which they may breathe in water) and lungs (through which they may breathe on land). The first order of Reptiles possesses this character, and hence its name of *Amphibia*, from a Greek word meaning having a double life.

2. All these creatures seem to have been well known to the ancients. The monuments of the Egyptians abound in representations of frogs, toads, tortoises, and serpents. Aristotle was well acquainted with their form, structure, and habits, even to their reproduction. Pliny's description, however, presents some amount of error and exaggeration. Darkness envelops their history during the Middle Ages, from which it gradually emerges in the early part of the sixteenth century, when Belon and Rondeletius in France, Salviani in Italy, and Conrad Gesner in Switzerland, devoted themselves to the study of natural history with great success. In the latter part of the same century Aldrovandi appeared. During fifty years he was engaged in collecting objects and making drawings, which were published after his death, in 1640, being edited by Professor Ambrossini, of Bologna, the reptiles forming two volumes: in these volumes, twenty-two chapters are occupied by the serpents. But the first arrangement which can be called systematic was that produced by John Ray, who

based his system upon their mode of respiration, the volume of their eggs, and their color. Numerous systems have since appeared in France, Germany, and England; but we shall best consult the interest of the reader by briefly describing the classification adopted by Professor Owen in his great work on the vertebrata.

3. The two great classes Batrachians and Reptiles, include a number of animals which are neither clothed with hair, like the mammalia, covered with feathers like the birds, nor furnished with swimming fins like fishes. The essential character of reptiles is, that they are either entirely or partially covered with scales. Some of them—for instance, serpents—move along the ground with a gliding motion, produced by the simple contact and adhesion of the ventral scales with the ground. Others, such as tortoises, crocodiles, and lizards, move by means of limbs; but these again are so short, that the animals, with very few exceptions, appear only capable of crawling slowly. Again, some of this class are only furnished with feet in the pectoral region; but this is the exception. The locomotive organs in serpents are the vertebral column, with its muscles, and the stiff epidermal scutes crossing the under surface of the body. "A serpent may, however, be seen to progress," says Professor Owen, "without any inflection, gliding slowly and with a ghost-like movement in a straight line; and if the observer have the nerve to lay his hand flat in the reptile's course, he will feel, as the body glides over the palm, the surface pressed as it were by the edges of a close-set series of paper knives successively falling

flat after each application." In some, as in various lizards, the limbs acquire considerable strength.

4. Batrachians, again, differ from most other *Reptilia* by being naked; moreover, most of them undergo certain metamorphoses. In the first stage of their existence they lead a purely aquatic life, and breathe by means of gills, after the manner of fishes. Young frogs, toads, and salamanders, which are then called tadpoles, have at that stage no resemblance whatever to their parents in structure. They are little creatures with slender, elongated bodies, destitute of feet and fins, but with large heads. In stagnant ponds they are frequently found in numbers, where they live and breathe after the manner of fishes. By degrees, however, they are transformed, their limbs and air-breathing lungs commence to develop, when they disappear, till the day arrives that they find themselves organized for another existence, when they leave their liquid retreat and betake themselves to dry land.

5. The respiration of reptiles and some of the batrachians, like that of birds and mammals, is aërial and pulmonary, but it is much less active. Batrachians have, in addition, a very considerable cutaneous respiration. Some of these, such as toads, absorb more oxygen through the skin than by the lungs. Their circulation is imperfect, the structure of the heart only representing one ventricle; the blood, returning after a partial regeneration in the lungs, mingles with that which is not yet revivified: this mixed fluid is launched out into the economic system of the animal. Thus reptiles and batrachians are said

to be cold-blooded animals, more especially the former, in which the respiratory organs, which are a constant source of interior heat, are only exercised very feebly. Owing to this low temperature of their bodies, reptiles affect warm climates, where the sun exercises its power with an intensity unknown in temperate regions; hence it is that they abound in the warm latitudes of Asia, Africa, and America, while comparatively few are found in Europe. This is also the cause of their becoming torpid in our latitudes during the winter, not having sufficient heat in themselves to produce reaction against the external cold, reawakening only when the temperature permits of their activity. Serpents, lizards, tortoises, frogs, are all subjected to this law of their being. Some hibernate upon the earth, under heaps of stone, or in holes; others in mud at the bottom of ponds. The senses are very slightly developed in these animals; those of touch, taste, and smell being very imperfect; hearing scarcely so much so; but not so with sight, for their large eyes are provided with contractile eyeballs, which enables certain reptiles—such, for instance, as the geckos—to distinguish objects in the dark. Most reptiles and batrachians are almost devoid of voice; serpents, however, utter a sharp hissing sound, and crocodiles howl; again geckos are particularly noisy, and frogs possess the well-known croak.

6. Reptiles and batrachians can, it is true, be tamed; but although they seem to know individuals, they do not appear susceptible of affection; this may be attributed to the slight compass of their brain, as also that insensibility to pain which enables them to

support mutilations that would prove immediately fatal to other animals. For instance, the common lizard frequently breaks its tail in its abrupt movements. Nor does this curtailment affect him; for complaisant Nature renews its growth as often as it becomes necessary. In the crocodiles and monitor lizards, however, a mutilated part is not renewed, and the renovated tails of other lizards do not develop bone. In some instances, the eyes may be put out, or the animal otherwise seriously injured. In the course of time, without the animal having ceased to perform any of its functions, they will be renewed. A tortoise will continue to live and walk for six months after it is deprived of its brain; and a salamander has been seen in a very satisfactory state, although its head was, so to speak, isolated from the trunk by a ligature tied tightly round its neck.

7. There is another curious peculiarity in the history of reptiles and batrachians: each year, as they awake from their state of torpor, they slough their old covering, or, in other words, cast their skin. Their growth is slow, and continues almost through the whole duration of their existence; they are, moreover, endowed with remarkable longevity. This is not very astonishing, if we consider that (at least in our latitudes) they remain torpid for several months yearly; thus using up less of the materials of life, and, consequently, ought to attain a more advanced age. The activity of organization in reptiles and batrachians is so slight that their stomachs feel less of the exigencies of hunger; hence they rarely take nourishment, and digest their food very slowly. With the exception

of the land tortoises, whose regimen is herbivorous, most reptiles feed on living prey. Some, such as lizards, frogs, and toads, subsist on worms, insects, small terrestrial or aquatic mollusks; others, such as ophidians and crocodiles, attack birds, and even mammals. Large serpents, owing to the distensibility of their œsophagus, frequently swallow animals broader than themselves at the moment of seizing their prey.

8. Reptiles, whether batrachians, ophidians or chelonians, are mostly oviparous, sometimes ovo-viviparous, and generally very prolific. The eggs of some are covered with a calcareous envelope, as in the turtle. Sometimes they are soft, and analogous to the spawn of fish, as in the batrachians. Most species do not hatch their eggs by sitting upon them, but bury them in the sand, trusting to the heat of the sun, which hatches them in due course. To this the pythons form a partial exception. Batrachians content themselves with diffusing their spawn or eggs in marshy waters or ponds, or they bear them on their backs until the time of hatching approaches. On leaving the egg young tortoises have to provide immediately for their own wants, for the parents are not present to bring them nourishment or to defend them against enemies. Parental affection, so manifest among the superior animals, does not exist in oviparous species, except in those that hatch their eggs in the body of the mother. The young are consequently, so to speak, produced in a living state, and fully prepared for the battle of life. The loves of these animals present none of that character of mutual affection and tender sympathy which distinguishes the mam-

malia and birds. When they have insured the perpetuity of their species, they separate, and betake themselves again to their solitary existence.

9. Some reptiles attain dimensions truly extraordinary, which render them most formidable. Turtles are met with which weigh as much as sixteen hundred pounds; and carapaces have been found that measured as much as six feet in length. Although the average length of the crocodile is about eight to nine feet, they have been seen twenty-four and even thirty feet long.

10. In tropical regions enormous serpents are found, which are nearly a foot in diameter; and some are reported to have almost reached forty feet in length. Roman annals mention one forty feet long, which Regulus encountered in Africa during the Punic Wars, and which is fabulously said to have arrested the march of his army. These gigantic reptiles are not, however, enemies which man has most cause to fear, for their very size draws attention to them, enabling them to be avoided. Not so with the more minute poisonous snakes, which glide after their prey without attracting attention, strike it, and puncture the wound with venom, which produces death with startling rapidity. Doubtless this fatal power was the cause of barbarous nations of old worshiping certain reptiles; even at the present time these animals are venerated by some barbarous races of men.

11. The whole class of reptiles are for the most part calculated to inspire feelings of repugnance, and such has been the prevailing sentiment in all ages. There are people who cannot suppress a movement

of fright at the sight of an ordinary snake, lizard, or frog, notwithstanding that they are most inoffensive animals. Several causes concur to produce this aversion. In the first place the low temperature of their bodies, contact with which communicates an involuntary shudder in the person who touches them; then the moisture which exudes from the skins of frogs, toads, and salamanders, their fixed and strong gaze, all combine to impress one painfully, while the odor which some of them exhale is so disgusting, that it has often been known to produce fainting; add to this the fear of a real though often exaggerated danger, and we shall have the secret of the sort of instinctive horror which is felt by many people at the sight of most reptiles. Nevertheless, the poisonous species are exceptional among reptiles, and among batrachians there are none, for it is altogether a mistake to take for venom the fluid which the toad discharges. Although these animals are repulsive in appearance, we can nevertheless recognize their services in the economy of Nature. Inhabitants of slimy mud and fetid swamps, they are incessantly destroying worms and insects which abound there, and which ultimately would become most injurious to animal and vegetable life; while, in their turn, they find implacable enemies in the birds, which check an excessive increase in their race. In this manner the equilibrium of Nature is maintained.

12. Some of the animals which now occupy our attention render a direct service to man, being utilized by him for food. Frogs are eaten in the south of France, Italy, and many other countries; and adders,

under the name of "hedge-eels," are not despised in some localities. We know the favor in which turtles are held by us, where soup made from them is considered a dish only fit for merchant princes. In other countries, iguanas, crocodiles, and even serpents are eaten. But viper-broth, which was known to Hippocrates, we believe, is not to be found now as an article of food.

13. As we have already remarked, the peculiar nature of their organization leads reptiles and batrachians to seek the warmer regions of the earth. It is in those regions that they attain the enormous dimensions which distinguish certain serpents; there, too, they secrete their most subtle poisons and display the most lively colors, which, if less rich than those of birds and fishes, are not less startling in effect. Many serpents and lizards glitter with radiant metallic reflections; and some of them present extremely varied combinations of color. Chameleons are found in the same localities, but in the Old World only; these and some other lizards are remarkable for changing their color, a phenomenon which is also seen among the frogs, but in a smaller degree.

LOUIS FIGUIER, "Reptiles and Birds."

HUMMING-BIRDS.

1. The wonderful little Humming-Birds are only found in America and the adjacent islands, where they take the place of the sun-birds of the Old World. It is rather remarkable that, as yet, no humming-birds have been discovered in Australia.

2. These little winged gems are most capricious in their choice of locality, some being spread over a vast range of country, while others are confined within the limit of a narrow belt of earth hardly more than a few hundred yards in width, and some refuse to roam beyond the narrow precincts of a single mountain. Some of these birds are furnished with comparatively short and feeble wings, and, in consequence, are obliged to remain in the same land throughout the year, while others are strong of flight, and migrate over numerous tracts of country. They gather most thickly in Mexico and about the equator, the number of species diminishing rapidly as they recede from the equatorial line.

3. The name of humming-birds is given to them on account of the humming or buzzing sound which they produce with their wings, especially while they are hovering in their curious fashion over a tempting blossom, and feeding on its contents while suspended in air.

4. The legs of these birds are remarkably weak and delicate, and the wings are proportionately strong, a combination which shows that the creatures are in-

tended to pass more of their time in the air than on foot. Even when feeding they very seldom trouble themselves to perch, but suspend themselves in the air before the flower on which they desire to operate, and with their long slender tongues are able to feed at ease without alighting. In the skeleton, especially in the shape of the breastbone and wings, as well as in the comparative small size of the feet, the humming-birds bear some analogy to the swifts, and, like those birds, never lay more than two eggs.

5. The flight of these birds is inconceivably rapid, so rapid, indeed, that the eye can not follow it when the bird puts forth its full speed; and with such wonderful rapidity do the little sharp-cut wings beat the air, that their form is quite lost, and while the bird is hovering near a single spot, the wings look like two filmy gray fans attached to the sides. While darting from one flower to another the bird can hardly be seen at all, and it seems to come suddenly into existence at some spot, and as suddenly to vanish from sight. Some humming-birds are fond of towering to a great height in the air, and descending from thence to their nests or to feed, while others keep near the ground, and are seldom seen at an elevation of many yards.

6. The food of the humming-birds is much the same as that of the honeysuckers, except, perhaps, that they consume more honey and fewer flies. Still, they are extremely fond of small insects, and if kept away from this kind of diet soon pine away, in spite of unlimited supplies of syrup and other sweet food.

7. In order to enable the humming-bird to extract

the various substances on which it feeds from the interior of the flowers, the beak is always long and delicate, and in shape is extremely variable, probably on account of the particular flower on which the bird feeds. In some instances the bill is nearly straight, in others it takes a sharp sickle-like downward curve, while in some it possesses a double curve. The general form of the beak is, however, a very gentle downward curve, and in all instances it is pointed at its extremity. At the base the upper mandible is wider than the lower, which is received into its hollow. Their nostrils are placed at the base of the beak, and defended by a little scale-like shield.

8. The plumage is very closely set on the body, and is possessed of a metallic brilliancy in every species, the males being always more gorgeously decorated than their mates. The tail is composed of ten feathers, although in several species some of the feathers are so slightly developed that they can hardly be seen under the larger rectrices, and, in consequence, their owner has been set down as possessing only six feathers in its tail.

9. The tongue is a very curious structure, being extremely long, filamentous, and double nearly to its base. At the throat it is taken up by that curious forked bony structure called the hyoid bone, the forks of which are enormously elongated, and, passing under the throat and round the head, are terminated upon the forehead. By means of this structure the humming-bird is enabled to project the tongue to a great distance from the bill, and to probe the inmost recesses of the largest flowers. The common woodpecker has

a very similar description of tongue, and employs it in a like manner.

10. In their habits the humming-birds are mostly diurnal, although many species are only seen at dawn and just after sunset. Many, indeed, live in such dense recesses of their tropical woods, that the beams of the sun never fairly penetrate into their gloomy depths, and the humming-bird dwells in a permanent twilight beneath the foliage.

J. G. Wood, "The New Illustrated Natural History."

WASPS' NESTS.

1. Wasps, like bees, associate in great numbers, and construct, with much dexterity and skill, a common habitation. Their architecture, like that of the honey-bee, is singular and worthy of admiration; but the materials employed furnish neither honey nor wax. Impelled by an instinctive love of posterity, they, with great labor, skill and assiduity construct combs, which are likewise composed of hexagonal or six-sided cells. Though these cells are not made of wax, they are equally proper for the reception of eggs, and for affording convenient habitations to the worms which proceed from them, till their transformation into wasps.

2. In general, the cells of the wasps are formed of a kind of paper, which, with great ingenuity, is fabricated by the animals themselves. The number

of combs and cells in a wasp's nest is always proportioned to the number of individuals associated. Different species choose different situations for building their nests. Some expose their habitations to all the injuries of the air; others prefer the trunks of decayed trees; and others, as the common kind, of which we are principally treating, conceal their nests under ground. The hole which leads to a wasp's nest is about an inch in diameter. This hole is a kind of gallery mined by the wasps, is seldom in a straight line, and varies in length from half a foot to two feet, according to the distance of the nest from the surface of the ground. When exposed to view, the whole nest appears to be of a roundish form, and sometimes about twelve or fourteen inches in diameter. It is strongly fortified all round with walls or layers of paper, the surface of which is rough and irregular. In these walls, or rather in this external covering, two holes are left for passages to the combs. The wasps uniformly enter the nest by one hole, and go out by the other, which prevents any confusion or interruption to their common labors.

3. Upon removing the external covering, we perceive that the whole interior part consists of several stories or floors of combs, which are parallel to each other, and nearly in a horizontal position. Every story is composed of a numerous assemblage of hexagonal cells, very regularly constructed with a matter resembling ash-colored paper. These cells contain neither wax nor honey, but are solely destined for containing the eggs, the worms which are hatched from them, the nymphs, and the young wasps till they are

able to fly. Wasps' nests are not always composed of an equal number of combs. They sometimes consist of fifteen, and sometimes of eleven only. The combs are of various diameters. The first, or uppermost, is often only two inches in diameter, while those of the middle sometimes exceed a foot. The lowest are also much smaller than the middle ones. All these combs, like so many floors or stories ranged in a parallel manner above each other, afford lodging to prodigious numbers of inhabitants. Réaumur computed, from the number of cells in a given portion of comb, that, in a medium-sized nest, there were at least ten thousand cells. This calculation gives an idea of the astonishingly prolific powers of these insects, and the vast numbers of individuals produced in a single season from one nest; for every cell serves as a lodging to no less than three generations. Hence a moderate-sized nest gives birth annually to thirty thousand young wasps.

4. The different stories of combs are always about half an inch high, which leaves free passages to the wasps from one part of the nest to another. These intervals are so spacious, that, in proportion to the bulk of the animals, they may be compared to great halls or broad streets. Each of the larger combs is supported by about fifty pillars, which at the same time give solidity to the fabric, and greatly ornament the whole nest. The lesser combs are supported by the same ingenious contrivance. These pillars are coarse, and of a roundish form. Their bases and capitals, however, are much larger in diameter than the middle. By the one end they are attached to

the superior comb, and by the other to the inferior. Thus between two combs there is always a species of rustic colonnade. The wasps begin at the top, and build downward. The uppermost and smallest comb is first constructed. It is attached to the superior part of the external covering. The second comb is fixed to the bottom of the first; and in this manner the animals proceed till the whole operation is completed. The connecting pillars are composed of the same kind of paper as the rest of the nest. To allow the wasp entries into the void spaces, roads are left between the combs and the external envelope or covering.

5. A general idea of this curious edifice having been given, it is next natural to inquire how the wasps build, and how they employ themselves in their abodes. But as all these mysteries are performed under cover, it required much industry and attention to discover them. By the ingenuity and perseverance of M. de Réaumur, however, we are enabled to explain some parts of their internal economy and manners. This indefatigable naturalist contrived to make wasps, like the honey-bees, lodge and work in glass hives. In this operation he was greatly assisted by the ardent affection which these animals have for their offspring; for he found that, though the nest was cut in different directions, and though it was exposed to the light, the wasps never deserted it, nor relaxed in their attention to their young.

6. Immediately after a wasps' nest has been transported from its natural situation, and covered with a glass hive, the first operation of the insects is to repair

the injuries it has suffered. With wonderful activity they carry off all the earth and foreign bodies that may have accidentally been conveyed into the hive. Some of them occupy themselves in fixing the nest to the top and sides of the hive by pillars of paper, similar to those which support the different stories or strata of combs; others repair the breaches it has sustained; and others fortify it by augmenting considerably the thickness of its external cover. This external envelope is an operation peculiar to wasps. Its construction requires great labor; for it frequently exceeds an inch and a half in thickness, and is composed of a number of strata or layers as thin as paper, between each of which there is a void space. This cover is a kind of box for inclosing the combs, and defending them from the rain which might otherwise penetrate them. For this purpose it is admirably adapted. If it were one solid mass, the contact of water would penetrate the whole and reach the combs. But to prevent this fatal effect, the animals leave considerable vacuities between the vaulted layers, which are generally fifteen or sixteen in number. By this ingenious piece of architecture, one or two layers may be moistened with water, while the others are not in the least affected.

7. The materials employed by wasps in the construction of their nests are very different from those made use of by the honey-bee. Instead of collecting the farina of flowers, and digesting it into wax, the wasps gnaw with their two fangs, which are strong and serrated, small fibers of wood from the sashes of windows, the posts of espaliers, garden doors, etc., but

never attempt growing or green timber. These fibers, though very slender, are often a line, or a twelfth part of an inch, long. After cutting a certain number of them, the animals collect them into minute bundles, transport them to their nests, and, by means of a glutinous substance furnished from their own bodies, form them into a moist and ductile paste. Of this substance, or *papier maché*, they construct the external cover, the partitions of the nest, the hexagonal cells, and the solid columns which support the several layers or stories of combs.

8. The constructing of the nest occupies a comparatively small number of laborers. The others are differently employed. Here it is necessary to remark, that the republics of wasps, like those of the honey-bees, consist of three kinds of flies, males, females, and neuters. Like the bees, also, the number of neuters far surpasses that of both males and females. The greatest quantity of labor is devolved upon the neuters; but they are not, like the neuter bees, the only workers; for there is no part of their operations which the females, at certain times, do not execute. Neither do the males, though their industry is not comparable to that of the neuters, remain entirely idle. They often occupy themselves in the interior part of the nest. The greatest part of the labor, however, is performed by the neuters. They build the nest, feed the males, the females, and even the young. But while some of the neuters are employed in these different operations, the others are abroad in hunting parties. Some attack with intrepidity live insects, which they sometimes carry entire to

the nest; but they generally transport the abdomen or belly only. Others pillage butchers' stalls, from which they often arrive with a piece of meat larger than the half of their own bodies. Others resort to gardens, and suck the juices of fruits. When they return to the nest, they distribute a part of their plunder to the females, to the males, and even to such neuters as have been usefully occupied at home. As soon as a neuter enters the nest it is surrounded by several wasps, to each of whom it freely gives a portion of the food it has brought. Those who have not been hunting for prey, but have been sucking the juices of fruits, though they seem to return empty, fail not to regale their companions; for they station themselves upon the upper part of the nest, and discharge from their mouths two or three drops of a clear liquid, which are immediately swallowed by the domestics.

WILLIAM SMELLIE, "The Philosophy of Natural History."

THE ENGLISH ROBIN.

1. SEE yon robin on the spray;
   Look ye how his tiny form
   Swells, as when his merry lay
   Gushes forth amid the storm.

2. Though the snow is falling fast,
   Speckling o'er his coat with white,—
   Though loud roars the chilly blast,
   And the evening's lost in night,—

3. Yet from out the darkness dreary
Cometh still that cheerful note;
Praiseful aye, and never weary,
Is that little warbling throat.

4. Thank him for his lesson's sake,
Thank God's gentle minstrel there,
Who, when storms make others quake,
Sings of days that brighter were.

HARRISON WEIR.

LIVING CORALS.

"We wandered where the dreamy palm
Murmured above the sleeping wave,
And through the waters clear and calm
Looked down into the coral cave."

1. AMONG the advantages of travel may well be reckoned the memories of scenes passed through—the adventures and labors shared in common with sympathizing companions—especially when the object of the journey was the observation and study of natural productions, fauna or flora, on land, river, or sea. Every practical marine zoölogist must have shared in the keen delight and curious expectancy of watching the rise of the dredging-machine, as it approached the deck from its foraging excursion below. How we hoped to find this or that—some particular specimen upon which we had set our hearts; and with what disappointment we turned away if nothing of value

was discovered, or only the commonest specimens appeared, of which we already had abundance! But did the eye perceive some unknown form, with what ardor it was secured, and yet with what gentleness and delicacy it was handled and inspected!—for experience had taught us that some of the most beautiful marine forms are not to be touched with impunity, many of them possessing stinging qualities, while others, like the brittle star, have the inconvenient habit of dismembering themselves if displeased or frightened.

2. There are many favorable locations for finding varied and curious specimens, such as the waters of the Mediterranean, the shores of Japan, and the coral islands of the Pacific; but, for those who cannot make extended voyages, there is perhaps no better hunting-ground for marine curiosities than the Bermuda islands. One reason for this probably is, that in favorable years the Gulf Stream throws many exotics on its shores; but a more permanent cause may be found in the fact that this group of islands is entirely organic, and that both fossil and living specimens of corals, mollusca, annelids, and wondrously beautiful fishes, may be found in abundance. But it is of coral alone that we now design to speak, and this interesting production may also be sought among the Florida Keys.

3. It is not strange that so curious and beautiful an object as coral should have early attracted the attention both of naturalists and ordinary travelers. Even the common seaman likes to take home a piece of coral to adorn his humble abode, while learned

scientists have reasoned and argued with pertinacity and zeal over the mystery of its construction. The Greeks named it the "Daughter of the Sea," but are not known to have investigated its nature or mode of growth. For a long period it was the subject of curious conjectures, such as that it was a vegetable formation, and again that it was soft while in the water; and only hardened on exposure to the air; and even to the present time there remain in the popular conception several curious errors in regard to its growth. Indeed, we have heard public speakers, clergymen and others, in pursuit of an illustration, speak of "the wonderful labors of the coral insect!" In this short phrase are involved two fundamental errors; for the coral-producers are neither laborers nor insects.

4. Another very common mistake is the supposition that they are exceedingly minute—even microscopic—in size. This is far from being the case. Having had several varieties under observation in my aquarium for years, I can assure the reader that they are not only large enough to be plainly seen by the naked eye, but they sometimes elongate themselves nearly an inch above the upper edge of their cell, measuring one-third of an inch in diameter.

5. But some one may ask, "If the coral-producers are not insects, what are they?" We answer, mainly polyps, with some hydroids and soft mollusks of the lowest class. These are all soft-bodied organisms, consisting of many varieties, having the organic function of secreting carbonate of lime, which, with some other ingredients, as silica and small portions of sand, composes the hard substance called coral.

6. The body of the polyp consists of a cylindrical skin, with an inside sac, which is the stomach, and is furnished at the top with thread-like appendages, with which it draws in its food. Whatever it does not wish to retain in the stomach it rejects by the mouth, having no other resource, as the lower end of the polyp is affixed to the stony substance. When expanded, these thread-like tentacles around the mouth give them a flower-like appearance. It is between the outer skin and the sac or stomach that the limestone is secreted which forms the coral substance.

7. It will thus be seen that the polyp does not gather or collect from external sources the material of the coral—does not in any correct sense work or "build" any more than a tree may be said to work as it grows into wood. Nature has simply provided that, in receiving its food, the polyp selects from the ingredients of the sea-water that which is capable of being reduced by simple functional processes into coral; just as a plant selects and secretes from the earth that kind of nourishment which makes stems, leaves, and buds.

8. Each mature polyp, when fixed in its cell, may be considered as resting upon the tombs of its ancestors; and, when it dies, its descendants will repeat the process over its remains, and its own body, within which its share of coral has been secreted, will be the base for a new living descendant.

9. The cells of the coral colony are not retreats into which the polyps come and go, like a bird building its nest, but part and parcel of the creature; just as much so as are the bones belonging to a human body

—with this difference, that in the case of the polyp the stony part (representing the osseous structure in man) is all at the lower portion, while the upper part is soft and flexible; but in a healthy condition they are inseparably combined.

10. It is well known that the power of secretion is inherent in all living tissue, while its matter and form are varied in every possible degree, from the animalcule to the superior mammal. This power or faculty is possessed in full perfection by what we call the lower forms of life, and it is among these we find the stone-makers; for the simplicity of their structure is such that they may be nearly all stone while yet the small portion of vital substance carries on the processes of nutrition and growth.

11. It is not generally known, outside of the circle of naturalists and the scientists connected with the Coast Survey service, that coral grows on our own North Atlantic shores, the popular belief being that all corals are to be sought for in warm climates. There is one variety at least, *Astrangia Daňæ*, which has been found on the shores of Massachusetts and Connecticut. But what we call true coral has not hitherto been kept in a living condition in any other private aquarium than my own. So far as I know, my acquisition is unique, being the only living specimen of the true coral-producing polyp preserved in captivity within the United States, though plenty of it may be found at the Florida Keys, some parts of the West Indies, and at the Bermudas. But these delicate creatures cannot be preserved except under favorable conditions; and constant care is required

when in the aquarium to see that no injurious substance or fellow-captives come in contact with them.

12. The *Astrangia*, specimens of which have been found in the vicinity of New Haven and other points along the Sound, differs in this particular from other varieties of coral: the polyp rises more prominently above its cell; the coral secretion being limited to its base, and not, as in the reef-building and some others, continuing the secretion between the outer walls of the internal sac and the epithecum. The tentacles have minute warty prominences upon them, which are full of lasso-cells. I have never seen specimens of this variety above three or four inches in diameter, by less than one in height. The specimens I have are fine indeed. I have seen them when the mass of little animals with their myriads of fleecy locks looked like a pure white ball of snow.

13. Among other varieties of coral which I have succeeded in preserving in health and good working order is a fine specimen of the species known as *Oculina*. Its peculiarity is its branched or tree-like form; its zoöthome, or mass of living occupants, when out in all their glory, are so numerous as nearly to hide the stony substance of the corallum, presenting the appearance of a stem and branches adorned with living flowers. In this variety the tentacles are shorter than in some other kinds, nor have they the power of elongating themselves to the same extent. They are colored, but not uniformly of one shade; they are often greenish or of an umber tint, with changeable iridescent color. They are usually considered more elegant than the reef-building variety,

from which their internal structure does not materially differ.

14. It will be perceived that the association of the polyps in all compound groups must be of the most intimate kind; for, though each individual has a separate mouth, tentacles, and stomach, yet the intervening tissue which connects them is subject to a free circulation of fluids through its pores or lacunes. Thus the zoöthome as a whole must be considered as a living mass of animal matter, which is all benefited by the nourishment received through the individual members. It is a perfect commonwealth of its kind, even exceeding in perfection that of the honey-bees; for there are no drones among the polyps.

15. How long the coral polyps will live is not known. I have preserved mine in pure sea-water for years, and they appear to be as fresh and healthy as ever, active and industrious; but this industry, as has been explained, does not consist in any such operation as "building." Their simple and sole business is eating; and that a strong stony structure is the result, is no more creditable to them than it is to a maple tree to secrete sugar, nor does it indicate any more effort.

16. The process of coral growth is, however, very slow, if my specimens are any criterion. But a very minute addition has been made to my corallum during the years that I have had it. I cannot say, however, whether it might not have progressed more rapidly had it been left in its original habitat.

17. But though my corallum has grown so slowly in height or lateral extent, it has increased very fairly

by gemmation or budding; a considerable number of infant polyps have been added to the group, always, so far as I have observed, in the autumn, October and November. At first the young *larvæ* are worm-like in form, whitish and semi-transparent; they are very agile, and dart about in all directions, swimming, as we may say, "stern foremost," as their mouths are always in the rear. But this life of freedom soon comes to an end: Fate has ordained that they shall become fixed to their parent-stem or some other stationary object. Their mode of swimming facilitates this result, the base having a natural tendency to adhere on contact; and thus its gay youth is soon exchanged for a sedentary life, with no other changes than that of eating and digesting their food.

18. There are few natural objects more pleasing than an association of these corallets; for, as the polyps rise above their cells and extend their fine long tentacles, resembling threads of pure white silk, waving them to and fro like the radiated petals of a fairy-flower swayed by a gentle zephyr, or, again, like a minute feather fan slightly concave at the edge, they present an exceedingly animated and elegant appearance. Sometimes, when nearly at rest and the filaments are more contracted, they suggest the appearance of a dense frost settled upon a bed of moss.

19. But these fairy-like implements, with which the coral-polyp gathers in its food, are not such innocent objects as they appear to the naked eye. Examined under a magnifying-glass, there may be observed on the tentacles a row of slight protuberances, one larger than the rest being situated at the tip.

A "Noble Fellow"

These might easily be mistaken for ornaments, but their character is far different: they may, in fact, be looked upon as the creature's armory, for within them lie concealed *cnidæ* or lasso-like filaments, sometimes called capsule-threads, which are capable of being thrown out to a distance many times the length of their own bodies. It is with these that they capture their prey; for these little soft animals are carnivorous in their habits, and indeed have not yet abandoned the barbarous practice of infusing poison into their darts. In each of these *cnidæ* is secreted an injurious fluid, which partially or wholly paralyzes the small *crustacea* or other animals which the tentacles seize; and whatever small prey falls within their grasp is very promptly and certainly secured. The mouth of the polyp being in the center of the upper portion of the body, the victim thus seized is rapidly passed into it by aid of the longer tentacles, and thence descends to the stomach.

WILLIAM E. DAMON, "Ocean Wonders."

CHARACTERISTICS OF THE DOG.

1. A FRENCH writer has boldly affirmed, that with the exception of women there is nothing on earth so agreeable, or so necessary to the comfort of man, as the dog. This assertion may readily be disputed, but still it will be allowed that man, deprived of the companionship and services of the dog, would be a solitary

and, in many respects, a helpless being. Let us look at the shepherd, as the evening closes in and his flock is dispersed over the almost inaccessible heights of mountains; they are speedily collected by his indefatigable dog—nor do his services end here: he guards either the flock or his master's cottage by night, and a slight caress, and the coarsest food, satisfy him for all his trouble. The dog performs the services of a horse in the more northern regions; while in Cuba and some other hot countries, he has been the scourge and terror of the runaway negroes. In the destruction of wild beasts, or the less dangerous stag, or in attacking the bull, the dog has proved himself to possess pre-eminent courage. In many instances he has died in the defense of his master. He has saved him from drowning, warned him of approaching danger, served him faithfully in poverty and distress, and if deprived of sight has gently led him about. When spoken to, he tries to hold conversation with him by the movement of his tail or the expression of his eyes. If his master wants amusement in the field or wood, he is delighted to have an opportunity of procuring it for him; if he finds himself in solitude, his dog will be a cheerful and agreeable companion, and maybe, when death comes, the last to forsake the grave of his beloved master.

2. There are a thousand little facts connected with dogs, which many, who do not love them as much as I do, may not have observed, but which all tend to develop their character. For instance, every one knows the fondness of dogs for warmth, and that they never appear more contented than when repos-

ing on the rug before a good fire. If, however, I quit the room, my dog leaves his warm berth, and places himself at the door, where he can the better hear my footsteps, and be ready to greet me when I re-enter. If I am preparing to take a walk, my dog is instantly aware of my intention. He frisks and jumps about, and is all eagerness to accompany me. If I am thoughtful or melancholy, he appears to sympathize with me; and on the contrary, when I am disposed to be merry, he shows by his manner that he rejoices with me. I have often watched the effect which a change in my countenance would produce. If I frown or look severe, but without saying a word or uttering a sound, the effect is instantly seen by the ears dropping, and the eyes showing unhappiness, together with a doubtful movement of the tail. If I afterward smile and look pleased, the tail wags joyously, the eyes are filled with delight, and the ears even are expressive of happiness. Before a dog, however, arrives at this knowledge of the human countenance, he must be the companion of your walks, repose at your feet, and receive his food from your hands: treated in this manner, the attachment of the dog is unbounded; he becomes fond, intelligent, and grateful. Whenever Stanislas, the unfortunate King of Poland, wrote to his daughter, he always concluded his letter with these words—" Tristan, my companion in misfortune, licks your feet: " thus showing that he had still one friend who stuck to him in his adversity.

3. The propensities of the dog, and some of them are most extraordinary, appear to be independent of

that instinct which Paley calls "a propensity previous to experience, and independent of instruction." Some of these are hereditary, or derived from the habits of the parents, and are suited to the purposes to which each breed has long been and is still applied. In fact, their organs have a fitness or unfitness for certain functions without education;—for instance, a very young puppy of the St. Bernard breed of dogs, when taken on snow for the first time, will begin to scratch it with considerable eagerness. I have seen a young pointer of three or four weeks old stand steadily on first seeing poultry, and a well-bred terrier puppy will show a great deal of ferocity at the sight of a rat or mouse.

4. Sir John Sebright, perhaps the best authority that can be quoted on this subject, says that he had a puppy of the wild breed of Australia; that the mother was with young when caught, and the puppy was born in the ship that brought her over. This animal was so like a wolf, not only in its appearance, but in all its habits, that Sir John at first doubted if it really were a dog, but this was afterward proved by experiment.

5. Of all the propensities of the brute creation, the well-known attachment of the dog to man is the most remarkable, arising probably from his having been for so many years his constant companion, and the object of his care. That this propensity is not instinctive is proved, by its not having existed, even in the slightest degree, in the Australian dog.

6. Sir John Sebright kept this animal for about a year, almost always in his room. He fed him himself, and took every means that he could think of to

reclaim him, but with no effect. He was insensible to caresses, and never appeared to distinguish Sir John from any other person. The dog would never follow him, even from one room to another; nor would he come when called, unless tempted by the offer of food. Wolves and foxes have shown much more sociability than he did. He appeared to be in good spirits, but always kept aloof from the other dogs. He was what would be called tame for an animal in a menagerie; that is, he was not shy, but would allow strangers to handle him, and never attempted to bite. If he were led near sheep or poultry, he became quite furious from his desire to attack them.

7. Here, then, we see that the propensities that are the most marked, and the most constant in every breed of domestic dogs, are not to be found in animals of the same species in their natural state, or even in their young, although subjected to the same treatment from the moment of their birth.

8. Notwithstanding the above-mentioned fact, we may, I think, consider the domestic dog as an animal *per se;* that is, that it neither owes its origin to the fox nor wolf, but is sprung from the wild dog. In giving this opinion, I am aware that some naturalists have endeavored to trace the origin of the dog from the fox; while others, and some of the most eminent ones, are of opinion that it sprung from the wolf. I shall be able to show that the former is out of the question. The wolf, perhaps, has some claim to be considered as the parent animal, and that he is susceptible of as strong attachment as the dog is proved by the following anecdote, related by Cuvier.

9. He informs us, that a young wolf was brought up as a dog, became familiar with every person whom he was in the habit of seeing, and in particular, followed his master everywhere, evincing evident chagrin at his absence, obeying his voice, and showing a degree of submission scarcely differing in any respect from that of the domesticated dog. His master, being obliged to be absent for a time, presented his pet to the *Ménagerie du Roi*, where the animal, confined in a den, continued disconsolate, and would scarcely eat his food. At length, however, his health returned, he became attached to his keepers, and appeared to have forgotten all his former affection; when, after an absence of eighteen months, his master returned. At the first word he uttered, the wolf, who had not perceived him among the crowd, recognized him, and exhibited the greatest joy. On being set at liberty, highly affectionate caresses were lavished on his old master, such as the most attached dog would have shown after an absence of a few days.

10. A second separation was followed by similar demonstrations of sorrow, which, however, again yielded to time. Three years passed, and the wolf was living happily in company with a dog, which had been placed with him, when his master returned, and again the long-lost but still-remembered voice was instantly replied to by the most impatient cries, which were redoubled as soon as the poor animal was set at liberty; when, rushing to his master, he threw his fore-feet on his shoulders, licking his face with the most lively joy, and menacing his keepers, who offered

to remove him, and toward whom, not a moment before, he had been showing every mark of fondness.

11. A third separation, however, seemed to be too much for this faithful animal's temper. He became gloomy, desponding, refused his food, and for a long time his life appeared in great danger. His health at last returned, but he no longer suffered the caresses of any but his keepers, and toward strangers manifested the original savageness of his species.

12. Mr. Bell, in his "History of Quadrupeds," mentions a curious fact, which, I think, still more strongly proves the alliance of the dog with the wolf, and is indeed exactly similar to what is frequently done by dogs when in a state of domestication. He informs us that he "remembers a female wolf at the Zoölogical Gardens, which would always come to the front bars of her den to be caressed as soon as he, or any other person whom she knew, approached. When she had pups, she used to bring them in her mouth to be noticed; and so eager, in fact, was she that her little ones should share with her in the notice of her friends, that she killed all of them in succession by rubbing them against the bars of her den, as she brought them forward to be fondled."

13. It must, in fact, be always an interesting matter of inquiry respecting the descent of an animal so faithful to man, and so exclusively his associate and his friend, as the dog. Accordingly, this question has been entertained ever since Natural History took the rank of a science. But the origin of the dog is lost in antiquity. We find him occupying a place in the earliest pagan worship; his name

has been given to one of the first-mentioned stars of the heavens, and his effigy may be seen in some of the most ancient works of art. Pliny was of opinion that there was no domestic animal without its unsubdued counterpart, and dogs are known to exist absolutely wild in various parts of the Old and New World. The dingo of Australia, a magnificent animal of this kind, has been shown to be susceptible of mutual attachment in a singular degree, though none of the experiments yet made have proved that he is capable, like the domestic dog, of a similar attachment to man. The parentage of the wild dogs has been assigned to the tame species, strayed from the dominion of their masters. This, however, still remains a question, and there is reason to believe that the wild dog is just as much a native of the wilderness as the lion or tiger. If there be these doubts about an animal left for centuries in a state of nature, how can we expect to unravel the difficulties accumulated by the ages of domestication? Who knows for a certainty the true prototype of the goat, the sheep, or the ox? To the unscientific reader such questions might appear idle, as having been settled from time immemorial; yet they have never been finally disposed of. The difficulty, as with the dog, may be connected with modifications of form and color, resulting from the long-continued interference of man with the breed and habits of animals subjected to his sway.

EDWARD JESSE, "Anecdotes of Dogs."

BUFFON.

1. George Louis Leclerc, Comte de Buffon, was born on the 7th of September, 1707, at Montbard, in Burgundy, and died at Paris on the 15th of April, 1788. His father, M. Leclerc de Buffon, was councillor of the Burgundian parliament, and his mother, Anne Christine Marlin, appears to have possessed considerable natural gifts. Buffon was the eldest of five children, and does not seem to have been in any way a precocious child. On the contrary, he seems from his earliest years to have been characterized more especially by great perseverance, patience, knowledge of the value of time, and exceptional powers of steady application and protracted labor. He was originally destined to his father's profession, and studied law at the college of Jesuits at Dijon; but he soon exhibited a marked predilection for the study of the physical sciences, and more particularly for mathematics.

2. While at Dijon he made the acquaintance of Lord Kingston, a young Englishman, who was at the time staying there along with his tutor, a man of ability and discernment. In this agreeable companionship, Buffon traveled through Italy, being then nineteen years of age. Returning to France, he commenced to study at Angers, still in company with Lord Kingston; but having quarreled with a young Englishman at play, and subsequently wounded him, he was compelled to leave this town. He there-

upon removed to Paris, and during his sojourn in the capital he translated Newton's "Fluxions" and Hale's "Vegetable Statics," which he subsequently presented to the Academy of Sciences. From Paris he proceeded to England, where he remained three months; but his travels seem to have ended here. At twenty-five years of age he succeeded to a considerable property, inherited from his mother, and from this time onward his life was a completely independent one, and he was enabled to devote himself entirely to his scientific pursuits. He returned now to France, and lived partly at Montbard and partly at Paris.

3. Though loving pleasure, and not keeping himself free from the prevalent vices of the age in which he lived, Buffon spent the remainder of his life in regular scientific labor, employing an amanuensis, and thus securing a permanent record of his work. At first he directed his attention more especially to mathematics, physics, and agriculture, and his chief original papers are connected with these subjects. In the spring of 1739 he was elected a member of the Academy of Sciences; and at a later period of the same year he was appointed keeper of the *Jardin du Roi* and of the Royal Museum. This appears to have finally determined him to devote himself to the biological sciences in particular, and he commenced to collect materials for his "Natural History." In the preparation of this voluminous work, he associated with himself Daubenton, to whom the descriptive and anatomical portions of the treatise were intrusted, and the first three volumes made their appearance

in the year 1749. In the year 1752 he married Marie Françoise de Saint-Belin. He seems to have been greatly attached to her, and felt deeply her death, which took place at Montbard in 1769. The remainder of Buffon's life, as a private individual, presents nothing of special interest. He belonged to a very long-lived race, his father having attained the age of ninety-three, and his grandfather eighty-seven years. He himself died at the age of eighty-one, of vesical calculus, having refused to allow of any operation for his relief. He left one son, who was an officer in the French army, and who died by the guillotine, at the age of thirty, having espoused the party of the Duke of Orleans.

4. Buffon was a member of the French Academy, perpetual treasurer of the Academy of Sciences, Fellow of the Royal Society of London, and member of the Academies of Berlin, St. Petersburg, Dijon, and of most of the learned societies then existing in Europe. Of handsome person and noble presence, endowed with many of the external gifts of nature, and rejoicing in the social advantages of high rank and large possessions, he is mainly known by his published scientific writings. Without being a profound original investigator, in the modern sense of this term, Buffon possessed considerable power of generalization, along with the art of expressing his ideas in a clear and generally attractive form. His chief defects as a scientific writer are, that he was given to excessive and hasty generalization, so that his hypotheses, however seemingly brilliant, are often destitute of any sufficient basis in observed facts, while his literary

style is not unfrequently theatrical and turgid, and a great want of method and order is commonly observable in his writings.

5. His great work is the "*Histoire Naturelle générale et particulière;*" and it can undoubtedly claim the merit of having been the first work to present the previously isolated and apparently disconnected facts of natural history in a popular and generally intelligible form. The sensation which was made by its appearance in successive parts was very great, and it certainly effected much good in its time by generally diffusing a taste for the study of nature. For a work so vast, however—aiming, as it did, at being little less than a general encyclopædia of the sciences—Buffon's capacities may, without disparagement, be said to have been insufficient, as is shown by the great weakness of parts of the work (such as that relating to mineralogy). The "*Histoire Naturelle*" passed through several editions, and was translated into various languages. The edition most highly prized by collectors, on account of the beauty of its plates, is the first, which was published in Paris (1749–1804) in forty-four quarto volumes, the publication extending over more than fifty years. In the preparation of the first fifteen volumes of this edition Buffon was assisted by Daubenton, and subsequently by Guénean de Montbéliard, the Abbé Bexon, and Sonnini de Manoncourt. The following seven volumes form a supplement to the preceding, and appeared in 1774–'89. These were succeeded by nine volumes on Birds (1770–'83), and these were followed by five volumes on Minerals (1783–'88). The remaining eight vol-

umes, which complete this edition, appeared after Buffon's death, and comprise Reptiles, Fishes, and Cetaceans. They were executed by Lacépède, and were published in successive volumes between 1788 and 1804. A second edition was commenced in 1774 and completed in 1804, in thirty-six volumes quarto. It is in most respects similar to the first edition, except that the anatomical descriptions of Daubenton are preserved. Though not without his enemies—scientific and clerical—Buffon had many warm friends, and his death was marked by the delivery of highly laudatory addresses, by Condorcet at the Academy of Sciences, Vicq-d'Azir at the *Académie Française*, and Bressonet before the Society of Agriculture. Extravagantly belauded by some, and vehemently attacked by others, we can recognize his merits without blinding ourselves to his defects.

6. This brief notice of his life may be fitly closed by the following quotation from Cuvier, in which the great French naturalist, while rejecting some speculations which recent science has generally accepted as probable, ascribes to Buffon the honor of being the first to clearly apprehend what is now admitted as the true principle of guidance in investigating the order of the universe:—"It is impossible to defend, in all their details, either the first or the second of Buffon's theories of the earth. This comet which strikes off portions of the sun, these vitrified and incandescent planets which refrigerate by degrees, some more rapidly than others, those organized beings which appear successively on the surface of the planets, as their temperature becomes sufficiently lowered, can only

be regarded as flights of fancy. But Buffon has not less the merit of having been the first to point out clearly that the actual condition of the globe is the result of a succession of changes, of which we can find the evidences to-day; and it is he who first drew the observation of all investigators to the phenomena by which these changes can be unraveled."

ANONYMOUS, "Encyclopædia Britannica."

THE LION'S RIDE.

1. THE lion is the desert's king; through his domain so wide
   Right swiftly and right royally this night he means to ride.
   By the sedgy brink, where the wild herds drink, close couches the grim chief;
   The trembling sycamore above whispers with every leaf.

2. At evening, on the Table Mount, when ye can see no more
   The changeful play of signals gay; when the gloom is speckled o'er
   With kraal fires; when the Caffre wends home through the lone karroo;
   When the boshbok in the thicket sleeps, and by the stream the gnu;

The "King of Beasts."

3. Then bend your gaze across the waste,—what see ye? The giraffe,
Majestic, stalks toward the lagoon, the turbid lymph to quaff;
With outstretched neck and tongue adust, he kneels him down to cool
His hot thirst with a welcome draught from the foul and brackish pool.

4. A rustling sound, a roar, a bound,—the lion sits astride
Upon his giant courser's back. Did ever king so ride?
Had ever king a steed so rare, caparisons of state
To match the dappled skin whereon that rider sits elate?

5. In the muscles of the neck his teeth are plunged with ravenous greed;
His tawny mane is tossing round the withers of the steed.
Up leaping with a hollow yell of anguish and surprise,
Away, away, in wild dismay, the cameleopard flies.

6. His feet have wings; see how he springs across the moonlit plain!
As from their sockets they would burst, his glaring eyeballs strain;

In thick black streams of purling blood, full fast his life is fleeting;
The stillness of the desert hears his heart's tumultuous beating.

7. Like the cloud that, through the wilderness, the path of Israel traced,—
Like an airy phantom, dull and wan, a spirit of the waste,—
From the sandy sea uprising, as the water-spout from ocean,
A whirling cloud of dust keeps pace with the courser's fiery motion.

8. Croaking companion of their flight, the vulture whirs on high;
Below, the terror of the fold, the panther fierce and sly,
And hyenas foul, 'round graves that prowl, join in the horrid race;
By the footprints wet with gore and sweat, their monarch's course they trace.

9. They see him on his living throne, and quake with fear, the while
With claws of steel he tears piecemeal his cushion's painted pile.
On! on! no pause, no rest, giraffe, while life and strength remain!
The steed by such a rider backed may madly plunge in vain.

10. Reeling upon the desert's verge, he falls, and breathes his last;
The courser, stained with dust and foam, is the rider's fell repast.
O'er Madagascar, eastward far, a faint flush is descried:—
Thus nightly, o'er his broad domain, the king of beasts doth ride.

FERDINAND FREILIGRATH.

MIGRATIONS OF BIRDS.

1. No animal displays so much power and instinct in its distant excursions as the bird: these have really something prodigious in them. It is only by the aid of accurate instruments and knotty calculations that the sailor trusts himself upon the sea, whereas our winged travelers, without guide or compass, and without ever losing their way, transport themselves from the polar circle to the tropical regions. The cranes pass the summer on the stormy strands of Scandinavia, and the winter amid the ruins of the palaces of the Pharaohs.

2. The mechanism of birds is admirably suited to aid their rapid flight. Their aërial oars, moved by muscles of extraordinary power, easily adapt themselves to all the hazards of their peregrinations through the elevated regions of air. There are animals, as the swallow, for instance, to which flight is

so easy that they seem to make a sport of it. A passive force further assists their suspension in the plains of the atmosphere; air, rarefied by the warmth of the body, penetrates into all its cavities and even to the interior of the bones. Rendered thus specifically lighter, like Montgolfier balloons filled with warm gas, they float without effort amid the clouds. Such is the daring flight of those condors which launched themselves from the frozen summits of the Andes toward the sky, and soon disappeared from the sight of M. d'Orbigny, without one's being able to explain how they could breathe so rarefied an atmosphere.

3. The bird, though endowed with such a slight frame, nevertheless surpasses in strength the ponderous engines which glide along our railroads. Its vessels and fibers, notwithstanding their wonderful delicacy, work and resist more energetically than our heavy wheel-work and cast-iron tubes; in the one is seen the finger of God, in the other only the genius of man! Launched like an arrow into space, the bird, playing the while, silently clears twenty leagues an hour. A locomotive going at high pressure, enveloped in fire and smoke, attains the same speed only by consuming heaps of coke and water amid the infernal uproar of its wheels and pistons.

4. According to Sir Hans Sloane, the sea-mews which nestle on the rocks of Barbadoes take every day a journey over the sea of one hundred and thirty leagues, to amuse themselves and seek for food on a distant island. The industry of the animal thus excelling that of man.

5. On their adventurous excursions birds follow their track unerringly, guided by sensations of an unknown nature and of extreme delicacy, among which sight and smell play a great part. All historians relate that after the battle of Pharsalia, the putrid emanations from the dead heaped upon the ground attracted the vultures from Asia and Africa, which came thither to make their repast. It is certain, according to Humboldt, that if a horse or cow be killed in the most solitary passes of the Cordilleras, where one might think not even condors could exist, several of these sordid carnivorous birds, attracted by the stench, are soon seen arriving in order to gorge themselves with the putrefied flesh.

6. The migrations of certain birds are understood; we know from whence they start, where they halt, and where they end their journey. Thus, for instance, in autumn, bands of quails which are emigrating, constantly arrive exhausted at the island of Malta, where they meet with fatal hospitality. They are taken in swarms in the streets of the town and on the roads, and as the inhabitants cannot consume the whole of this living harvest, it is sent to distant markets. The deck of the ship in which I left the harbor was laden with them.

7. The mysterious emigration of the swallows has particularly occupied the attention of observers. Men could not make out what became of these charming visitors when they suddenly disappeared, and not long ago the strangest suppositions were indulged in on this head.

8. As these birds in autumn seek their prey in the

fens, and seem to plunge into them, it was for a long time believed that they buried themselves in the mud, only to issue again with the return of the spring warmth, which reanimated them after a six months' asphyxia. Olaus Magnus, a northern naturalist, more erudite than observing, was the first who propagated this fable, going so far as to maintain that the Norwegian fishermen often take in their nets a great number of swallows along with the fish. It was even asserted that if the poor birds, all soiled with mud, soaked with water, and stupefied with cold, were exposed to the heat of a stove, they were seen to become speedily dry and return to life.

9. Linnæus, Buffon, and even Cuvier, believed such stories! Ought we to consider this as a reproach on their parts, when we see that some physiologists of our own time obstinately maintain that certain animals can be reanimated?

10. As the swallows have for a long time concealed their winter residence, it became the subject of all sorts of conjectures. Some naturalists maintained that, instead of emigrating to distant regions, they hid themselves and became torpid in the depths of some cave, just as the bats do. One of the most reliable of these men, Larrey the surgeon, mentions having discovered in the neighborhood of Maurienne a grotto, the roof of which was lined with a mass of swallows which kept themselves attached to it like a swarm of bees.

11. But the experiments of Spallanzani have destroyed all these false creeds. The learned abbé found that the swallows which he wanted to throw

into a state of hibernation in an ice-house, did not become torpid, but died.

12. Adanson has taught us that the swallows betake themselves to the Senegal during the cold season. Those which are scattered through our lands unite together at autumn on the shores of the Mediterranean, and when an irresistible desire impels them to depart, cross this sea in numerous troops. Thus then in summer the swallow builds its nest under the sumptuous cornices of our palaces, and in winter inhabits the huts of Senegambia.

13. All do not attain the goal of their pilgrimage. The waves engulf those who have reckoned too much upon their strength, unless some propitious rock or ship happens to be at hand to lend them refuge. During one of my wanderings across the Mediterranean, some strayed swallows happened, when we were midway between the two coasts, to fall totally exhausted on the deck of the frigate which was carrying me toward Africa. Every one on board, soldiers and sailors, overwhelmed them with attentions, which they received without exhibiting signs of fear. When they had at last recovered from their fatigues, they recommenced their journey toward the high regions of Senegal, and perchance rested beneath the cabins of savages long ere we had greeted the ports of Algeria.

14. But after long and perilous journeys these charming visitors of our dwellings return each year with touching fidelity to find their old domicile again. If the rains and winds have injured it, the architects quickly repair it before making it witness of their

loves. Spallanzani has even noticed that the feathered couples become strongly attached to their particular nests. Having fixed party-colored ribbons to the feet of some of them, he recognized them the year after, when they came to take possession again. He saw them return thus for eighteen successive summers. How many among us never enjoy such a long tenancy!

15. Another species of the same group, the ariel swallow, fondly returns to its republic, formed of agglomerated nests, and more ingeniously constructed than those of our swallows. These nests resemble so many wide-necked bottles hung by the bottom in inaccessible places.

16. Less remarkable for the instinct which guides them than for the innumerable multitude of their army, the passenger pigeons (*Columba migratoria*) traverse the forests of America in such compact masses that they absolutely intercept the rays of the sun, and cast a long track of shadows on the ground. Their compact columns extend over such a space that the eye cannot take in the full extent of it. It has been calculated that it is often sixty leagues in length. The passing of these columns sometimes lasts three hours, and as these birds travel at the rate of nearly twenty leagues an hour, their army must necessarily extend over fifty to sixty leagues of sky.

17. This immense host never travels by night; so soon as ever darkness overtakes them, they precipitate themselves breathless and exhausted upon the nearest forest, there to rest from their fatigues. Their legions accumulate in such numbers upon the trees

that the great branches yield or break beneath their weight, and all the invaders are soon after composed to sleep. But scarcely are the pigeons installed there than all the able-bodied people in the country hasten to the spot, and make a complete carnage of them. The well-sustained noise and firing do not in the least interrupt the sleep of these harassed travelers. The victims fall; the women and children pick them up, or even kill with sticks those pigeons which have perched within their reach. The yield is so abundant, that, not being able to consume in the locality all the birds which are killed, they are often obliged to salt and pack them in barrels, so that they may be kept or sent to a distance.

18. The cold of winter drives most animals from the Polar regions, and compels them to withdraw to countries more favored by the sun. The penguins of the Cape alone seem to evade this universal law. These bird-fish, being intrepid swimmers, are most at home in the midst of the ices or the roaring waves. They only haunt the shores of Africa in order to scoop out their nests, hatch their eggs, and rear their young. When the young have become sufficiently robust to support the fatigues of the journey, all these *palimpedes*, mysteriously obeying an instinct of which the Creator alone knows the aim, suddenly disappear from the African shores, and seek during six months of winter the frightful regions of the south pole, condemned to incessant struggles amid tempests and ice. But at the return of spring the penguins reappear in numerous troops, and encumber anew the banks now smiling with verdure, grouping themselves

in long processions seemingly occupied only in reveling in light and love.

19. In contrast to these pictures of the wandering life of certain birds may be placed those in which, notwithstanding the strength of their wings, these tenants of the air live almost entirely at home, only flitting around the environs of the site which nourishes them and sees their birth. While in their daring flight some of the wading birds cleave their way through the clouds and sweep a whole hemisphere, a little family of humming-birds have only a rosebush for their universe. Like an elegant vase ornamented with lichens, the Colibri's downy nest of cotton is balanced on the extremity of the most slender branches of the plant, while these aërial diamonds make prey of the insects which the flowers attract, or drink the pearls of dew which their petals distil.

20. In the same manner the humming-birds, robed in changing green, which attract and charm all eyes, the "emeralds of Brazil" (*Chlorostilbon prasinus*), as they are commonly called, set up their family nests upon the slender pendant stems of the creepers, from the vicinity of which they rarely move. Rocked by the zephyr, the female broods tranquilly on her eggs, while her lord flits amorously near her; here are spent all the happy days of the gentle pair.

F. A. Pouchet, "The Universe."

THE SEA-ANEMONE.

1. The beautiful marine animal known as the sea-anemone though nearly allied to the coral polyp is not an architect, nor has it played an important part in the great changes of the ocean bottom, and thus indirectly in the formation of the planet. In beauty of tint and form these inhabitants of the sea rival the most exquisite products of the floral kingdom. But, in addition to loveliness of form and color, they have the superior attraction of vitality. These sea flowers are living animals, breathing, eating, digesting, and capable of changing their forms at will. A pink would be more curious if it could walk, a rose awaken greater interest if it could reach after its necessary nourishment and take care of its own buds. This is what the flowers of the sea do. Supported by a solid base and cylindrical stem, the observer sees them terminate like the corolla of a flower, as in the petals of the anemone which gives the animals its name. These charming and timid creatures are also called *actiniæ*, as indicating their tendency to form rays or stars, from the Greek word *aktin*, a ray.

2. The body of these animals is cylindrical in form, terminating beneath in a muscular disk, which is generally large and distinct, enabling them to cling vigorously to foreign bodies. It terminates above in an upper disk, bearing many rows of tentacles which differ from each other only in their size. These tentacles are often decorated with brilliant colors,

forming a species of collarette, consisting of tubes which can be contracted and extended, pierced at their points by an orifice, whence water can be drawn in or ejected at the will of the animal. Arranged in multiples of circles, they distribute themselves with perfect regularity around the mouth. These are the arms of the zoöphyte. The mouth of the sea-anemone, oval in form, is among the tentacles, and communicates with the stomach by a short tube. This stomach performs a variety of offices, for it is the digestive organ, the lungs, and from it are projected the young of the creature. The *ova*, or eggs, are held in the tentacles or feelers, and are fecundated in the month of September, when the embryos are developed. These then pass into the stomach, being afterward ejected from the mouth with the rejected portions of the food. So we see that it is the stomach that breathes, and the mouth which is the organ of birth.

3. The sea-anemones multiply their species in another manner, similar to the process employed by the coral polyp. Bud-like excretions appear on the edge of the base, which finally detach themselves from the mother and become separate animals. In fact, in some species there is still another method, which is thus described by Mr. Hogg, the naturalist. Wishing to detach an anemone from the aquarium, he only succeeded by violent efforts in tearing off the lower portion of the creature, six partly separated portions remaining attached to the glass. At the end of eight days it was noticed that these fragments of the animal seemed to have distinct contractile powers, and

that each had a row of tentacles. They developed shortly into six perfect anemones. Every part of these strange creatures thus became a living creature, while the mutilated mother continued to live as if nothing had happened. In short, sea-anemones may be cut limb from limb, divided and subdivided. Each part of the body is quickly replaced. Cut off the tentacles, and they are renewed in a very short time.

4. The sea-anemones vary in their habitat from pools near low-water mark to eighteen or twenty fathoms of water, whence they have been dredged up. "They adhere," says Dr. Johnson, "to rocks, shells, and other extraneous bodies by means of a glutinous secretion from their enlarged base; but they can leave their hold and remove to another station whensoever it pleases them, either by gliding along with a slow and almost imperceptible movement (half an inch in five minutes, as is their usual method), or by reversing the body and using the tentacles for feet, or, lastly, by inflating the body with water to make themselves buoyant, and allowing themselves to be driven by the random motion of the waves. They feed on shrimps, small crabs, whelks, and similar mollusks, and probably on all animals brought within their reach whose strength or agility is not sufficient to extricate them from the grasp of their numerous *tentacula*."

5. The sea-anemone passes nearly its whole life fixed to some rock, section of coral, the back of a crab or other crustacean. There it lives a sort of unconscious and obtuse existence, gifted with an instinct so obscure that it is not even conscious of the prey

in its vicinity until it is actually in contact, when it seizes it in its large mouth and swallows it. One naturalist tells the story of a large *actinia* who took a notion to swallow a scallop which it had captured. After much stretching it got the bivalve down into its stomach, and in due time the mollusk was digested. The problem then was to get rid of the shell. It was a double disaster: the scallop had been taken in, and so was the sea-flower. It was the same as if a guest at the table should swallow a tea-saucer. The anemone, however, proved equal to the emergency. It literally changed its base by dividing itself into two animals attached to the scallop shell as a foundation, each part becoming a perfect animal.

6. When free, the anemone swims backward, till its base encounters a firm object, and then it fixes itself by suction. There are two specimens which show a marked preference for the backs of crabs and similar animals. One is called the parasite anemone, and its favorite home is on the hard shell of the hermit-crab. As these crabs are great travelers, and frequently vacate their domiciles by taking possession of other empty shells, this species of anemone sees more of life than his cousins.

7. The sea-flowers differ greatly in size, form, and color, and also in special peculiarities of development and function; so that a large collection would have the appearance of an animated flower-garden composed of carnations, china-asters, dahlias, daisies, etc. "The beauty of many species," says Mr. Damon, "is greatly enhanced by the fact that several colors are combined in individual specimens. Thus some-

times the main body or column will be green with white or golden tentacles, and the base buff with a pink disk or tips, or crimson with azure spheroids; sometimes the whole animal will be of one color, varied by different tints and shades. Down below, in the caves of the sea, these wonderful creatures have for untold ages anticipated our modern 'combination suits,' and have appeared dressed in all the glory of scarlet and gold, pink and gray, blue and white, green and crimson; their exquisite taste always selecting accords or pleasing contrasts, and avoiding all discordant shades which would clash or 'kill' each other, such as we sometimes see in human productions."

8. The column-shaped body of the anemone is soft, but usually tough and tenacious, and consists of a simple sac or cavity, commonly broadened at the base and open at the top or mouth. The upper chambers of the cavity are prolonged into tentacles or feelers which extend in a number of rows around the mouth, forming, when they are all extended, a beautiful crown. "If these tentacles or feelers are touched, or if the creature is in any way alarmed, they are instantly contracted, and all the parts sink down and are drawn together into a compact mass. This is effected by the exudation of water from the cavities or chambers through a series of openings connected with the central cavity. Expansion takes place by the reversed action, filling these cells with water." Sometimes the power which they possess of altering their shape appears to be exercised for the mere pleasure of the thing. Now they will contract themselves into balls, partially elongated and expanded; then

they will stretch out their fringes or tentacles to their widest extent, like a many-petaled flower in full bloom; and again they will encircle themselves with belts or girdles, drawn more or less tight and shifting up and down, involving changes of form every minute.

9. "In addition to the tentacles," says the author last quoted, "these curious creatures are armed for attacking their prey with what we may call fine thread-like lassos, of arrow-like sharpness, called *cnidæ* (from a Greek word meaning a nettle), from which is transmitted a powerful stinging and benumbing sensation, deadly to small prey, the victim being affected as by a shock of electricity. This I know by experience, for, some years ago, when in Bermuda, while attempting to take a large *actinia* from a rock, one of these soft-looking beauties gave me a shock which disabled my arm for hours. It will easily be understood that this concealed battery enables the sea-anemones to conquer much larger and stronger creatures than they could hold simply by the tentacles; they often seize large shrimps and crabs far beyond their own size. Occasionally, however, if one of these finds an anemone weakened from any cause, it will take up a position upon the edge of its mouth, keeping it distended, and with its claws pluck out the food from the victim's sac and appropriate it to its own use. Sometimes, when such an attempt is made, a combat ensues, and then woe to the marauder if he has mistaken the strength of the sea-anemone! He will surely fall into his own trap."

10. A naturalist tells the story of the self-protective power of the *actinia* in the following sprightly

manner: "Let me invite you to a sight I have many times beheld. I have in captivity a hungry sea-flower. Knowing well what suits its palate, I take a delicate morsel like a pillule and let it fall in the water. It descends on the waving petals or *tentacula*, on the point of one of which the pretty creature has caught it in an instant. How delicate the adjustment upon its more than fairy fingers! For a few minutes it is balanced with the nicest poise on that dactylic petal. Ah! a voracious and unmannerly little bummer of a minnow sees the delicious morsel, and makes a rapid dash to snatch it from my pet. Good, good! Well done, my bonny! I did not see the slightest motion of that indignant flower creature; yet assuredly there was a movement, and an effectual one too, for the zoöphyte had shot one of its invisible shafts, and the ichthyic thief dashes off like one frantic with pain. Is he hurt? Likely. He is stung in the snout. See how he seems to shake his nose. He actually appears to sneeze again, and conducts himself much like a puppy that, uninvited, has thrust his nose into a basin of hot soup. Ah, ha! He is rubbing his fishy proboscis against a frond of sea-lettuce. Perhaps the salad may cool his burning pain. Sometimes, however, the insatiable stomach of the sea-flower is made to give up its prey. Among the successful robbers, shrimps are foremost. The shrimp, seeing the anemone devouring its food, will dash on it from a distance, and sometimes even extract the swallowed morsel from the stomach itself. Seating itself on the extended disk of the sea-flower, with its small feet it prevents the approach of the tentacles

at the same time that it inserts its claws into the digestive cavity and seizes the food. In vain the anemone tries to contract its gills and close its mouth. Sometimes the conflict between the zoöphyte and crustacean becomes serious. When the former is strong and robust the aggression is repelled, and the aggressive shrimp makes the dessert for the sea-flower's repast."

11. If the *actinia* is voracious, it has also great powers of fasting. These creatures have been known to live two and three years without any nourishment. They are said to be delicate eating, and to be in considerable favor for the table in Southern France, Italy, and Greece, the taste resembling closely that of the crab or lobster.

ANONYMOUS, "A World of Wonders."

SOME CURIOUS ANIMAL COMPANIONSHIPS.

1. IF it be true, as the old proverb informs us, that "Poverty makes us acquainted with strange bedfellows," so no less truly may it be asserted, that natural history science exemplifies for us instances of the strangest associations and companionships among both lower and higher animals. Nor are these associations always to be explained on the grounds of parasitism, or from other causes which zoölogy may plainly enough demonstrate. In cases

where one animal acts the part of an unconscious or unwilling "host" to other animals, which have taken up their abode within or upon it as "guests," the cause or principle of the association is quite explicable, on the ground that the parasites seek the bodies of other animals as their natural and rightful territory. And indeed, unless provided for, by gaining access to its own and generally limited territory, the parasite perishes, being literally unable to help itself.

2. The instances of companionship to which we specially refer, however, are very far removed in their essential features from the question of parasitism. Abundant examples, as we shall presently note, may be found, in which one animal form associates itself with another, often of widely different nature and status in the scale of being from itself; this association being generally of the most invariable kind. The one animal being found, we may safely and surely predict the presence of the other. Such instances of invariable and close companionship are very rarely to be explained on ordinary grounds, and present to the naturalist puzzles of the gravest and deepest kind. In the vast majority of cases, he fails to see any apparent benefit or aid to be derived by either of the associated beings; and it is exactly this want of object, if we may so term it, in the companionship of many animals, which forms one of the most inexplicable aspects of such studies.

3. It is a remarkable fact that an absolute disinterestedness marks many such companionships, although it is sometimes hard to draw the line which

shall separate pure "parasites" from mere "guests" and "lodgers." The well-known flower-like sea-anemones, so familiar as denizens of our sea-coasts, present several notable examples of curious companionship. It has been noted that small fishes are frequently in the habit of swimming about within the mouths and stomach-sacs of large anemones inhabiting tropical seas, evidently on the best of terms with their hosts. And this association may be shown to be rather inexplicable, in one sense at least, if we consider that the slightest touch is usually sufficient to cause the tentacles and mouth of sea-anemones to close upon foreign objects. Unfortunately crabs, for example, which chance in their peregrinations to stumble against a large sea-anemone, are quickly drawn into the mouth by the tentacles and swallowed. Noting this very natural feature of anemone-character, it seems curious to think of such a dainty morsel as a fish being permitted to swim at its ease literally within the stomach-sac, and within easy and tempting reach of its strange neighbor.

4. But this very kind of association evinces further curious characteristics; for observers have noted a little fish that not only lives within the Dahlia Wartlet Sea-anemone, but actually permits the anemone to contract itself, and to inclose it in its fleshy tomb without injury. Another sea-anemone —the *Adamsia palliata*—the pretty little "Cloak-anemone" of our English coasts, offers a most inexplicable case of companionship in its habitual association with a certain species of Hermit-crab—the *Pagurus Prideauxii*. The Hermit or Soldier Crabs are

well-known dwellers on the sea-beach, and ensconce themselves on the cast-off shells of whelks and other mollusks, for the purpose of protecting their soft bodies. On the shell which protects this veritable hermit, the cloak-anemone may almost certainly be found; and it is to be noted that only this species of crab, and the equally definite and single species of anemone, are the two beings which respectively form the association. The unvarying nature of the species is, in fact, as remarkable a feature in the case as the invariable nature of the companionship. And not only does the hermit crab appear tacitly and simply to tolerate his living burden, with which, like Sindbad the Sailor and the Old Man of the Sea, he persistently crawls about, but he also appears to exhibit a certain care and affection for the anemone. He has been noticed to feed the anemone with his pincer-like claws; and when—as is the custom of these animals—the crab casts away his shell, to seek another and larger abode, he has been seen carefully to detach the helpless anemone from the old habitation, and to assist it in gaining a firm basis and support on the new shell. Another species of hermit similarly makes a companion of another kind of anemone; the latter subsisting on the food-particles furnished by its host. These details may pardonably suggest to us the idea that there may be, after all, much that is identical in the motives of even such lower forms as hermit-crabs, with the actions which we are accustomed, perhaps too exclusively, to regard as peculiar to ourselves.

5. The familiar little Pea-crabs, or *Pinnotheres*—so named from the small size of their bodies—

present instances of a copartnership with salt-water mussels, the explanation of which is very hard indeed to find. Within the bodies of these mussels and of other mollusks, and within the folds of the structure which both lines and forms the shell, and which is appropriately named the "mantle," these little Pea-crabs appear to lodge in a perfectly natural and accustomed manner. As far as long-continued custom and habit are concerned, the Pea-crabs may well have become accustomed to their surroundings; for we find that Pliny of old, with other classical observers, was familiar with the fact of their unusual residence, and speculated on the causes which induced these animals to select their abodes. This old naturalist quaintly informs us that the mollusk being "a clumsy animal without eyes," opens its shell, and thereby allows other fishes to enter; and we are further informed that "the *Pinnothere* (or Pea-crab), seeing his dwelling invaded by strangers, pinches his host, who immediately closes his shell, and kills, one after another, these presumptuous visitors, that he may eat them at his leisure." Thus, the pea-crab is accredited at once with the virtue of efficient watchfulness and with the vice of jealousy; and so the case appears clear enough to this old naturalist, on the assumption that pea-crabs and mollusks are actuated by much the same motives as ourselves. The fact, however, of an active little body like the crab being allowed peacefully and naturally to dwell within the delicate, and usually irritable tissues of the well-known mussel, has as yet admitted of no satisfactory explanation at the hands of modern zoölogists. Pea-crabs are also found living

within those curious marine animals possessing bag-shaped bodies, and known as "sea-squirts;" the crab dwelling within the breathing-chamber of its host. The author has noticed the crab to emerge from the mouth-opening of the sea-squirt to feed in an aquarium, in which its host was a tenant; the crab-guest beating a hasty retreat to its shelter on being alarmed. Pea-crabs measuring over half an inch in length may frequently be taken from mussels of not by any means large proportions.

6. The great insect-class exemplifies many remarkable associations, most of which, however, are examples of parasitism. For instance, a curious relationship subsists between ants and certain species of beetles. Indeed, some species of beetles which are totally blind, are nowhere to be found save in the nests of certain kinds of ants. These beetles are further known to be carefully tended by the ants, who at once attack any intruder into their nests, however nearly allied the latter may be to their blind friends. This instance of companionship is more mysterious than the well-known friendship that exists between ants and plant-lice, since the beetles do not, so far as observation has gone, furnish any secretion to, or otherwise benefit their hosts. One species of these blind beetles (*Claviger Duvalii*) is only found within the nests of a species of ant—the *Lasius niger*. Some ant-nests of this species may, however, be destitute of these beetle-visitors; and when the latter are artificially introduced into such guestless homes, the ants at once kill them. M. Lespès, who has given us these details, thinks that the latter fact may be ac-

counted for by the supposition that some ant-colonies are more highly "civilized" than others; but this explanation is more ingenious than probable or satisfactory.

7. Among fishes, many examples of association with other fishes of widely different kinds, and for reasons not always apparent or explainable, are also to be found. The large, ungainly-looking fish possessing a very large head and wide mouth, frequently cast up on our shores after storms, and known as the Angler-fish or Fishing-frog (*Lophius piscatorius*), appears in many cases to give shelter, as a willing or unwilling host, to a kind of eel, which lives within its capacious gill-chambers. The eel-guest doubtless subsists on the food-particles which may find access to its abode, from the equally capacious mouth. The well-known Pilot-fish has received its name from its supposed habit of piloting sharks toward their prey; while, as was believed by the ancients, it also warned the sea-monster against dangers of all kinds. Of the mere fact of the companionship between sharks and the pilot-fish, there can be no doubt; but it seems to be doubtful if the attendance is of the disinterested kind just alluded to; as the contents of the stomach in the pilot-fish, we are told, generally consist of food which it has picked up for itself. It is therefore not a mere parasite, but may probably follow the shark from the expectation that its chances of picking up food are greatest in the neighborhood of so powerful a caterer.

8. The *Remora* or sucking-fish, in virtue of possessing a peculiar sucker on the top of its head, forms

associations with other fishes, probably as an aid to locomotion. Fixed to the body of another fish, this clinging companion is saved all further trouble of movement on its own account, and roams wheresoever its foster-friend may list. The ancients, it is curious to note, thoroughly believed in the powers of the *remora* to detain, by an exercise of immense or supernatural strength, any objects to which it might attach itself. Antony's ship at the battle of Actium, was reported to have been held fast by a *remora*, and the vessel of Caligula was alleged to have been similarly arrested. The fish itself attains the length of twelve or thirteen inches, and somewhat resembles a herring in its general shape.

9. In the class of birds, many notable examples of curious likes and dislikes of personal kind, if we may so style them, may be found. For while in some cases the friendly companionships are very evident, so no less are examples of aversions and dislikes. The cuckoos thus present us with curious instances of semi-parasitic habits, in their invasion of the nests of other birds for the purpose of depositing their eggs; and the association between the birds known as Ox-peckers (*Buphaga*) and cattle, is no less curious in its details, even if we consider that the reasons for the companionship are of very evident kind. The ox-peckers form a group of Perching Birds, inhabiting Africa; a familiar species being the Common Ox-pecker (*Buphaga Africana*); and their popular name, together with the designation—not applied to birds alone—of Beef-eaters, has been given to them from their habits of following herds of cattle in great num-

bers, and of perching on the backs of their bovine neighbors, for the purpose of extracting the *larvæ*, or caterpillar-forms of the troublesome bot-flies. The eggs of these flies being deposited in the back of the ox, and usually in a part which the animal is unable to reach with his tongue, give rise to a troublesome swelling, known as "worble," within which the young insects undergo part of their development. The ox-pecker alighting on the back of the ox, soon contrives, by aid of his powerful and peculiarly shaped bill, to extract the *larvæ*—an operation seemingly conducted with gentleness and skill, and apparently relished, as a relief from pain, by the subject of the operation; the oxen evincing no uneasiness or objection, consequent on the attentions of these birds. In like manner, starlings in our own country befriend sheep by ridding them of troublesome *larvæ*. In short, it would be difficult to find more typical cases of true co-operation for the purposes of mutual benefit, than those before us.

ANDREW WILSON, "Sketches of Animal Life and Habits."

TO THE SKYLARK.

1. HAIL to thee, blithe spirit!
Bird thou never wert,
That from heaven, or near it,
Pourest thy full heart
In profuse strains of unpremeditated art.

2. Higher still and higher
From the earth thou springest,
Like a cloud of fire;
The deep blue thou wingest,
And singing still dost soar, and soaring ever singest.

3. In the golden lightning
Of the setting sun
O'er which clouds are brightening,
Thou dost float and run;
Like an unbodied joy whose race is just begun.

4. The pale purple even
Melts around thy flight;
Like a star of heaven,
In the broad daylight
Thou art unseen, but yet I hear thy shrill delight.

5. Keen as are the arrows
Of that silver sphere,
Whose intense lamp narrows
In the white dawn clear,
Until we hardly see, we feel that it is there.

6. All the earth and air
With thy voice is loud,
As, when night is bare,
From one lonely cloud
The moon rains out her beams, and heaven is overflowed.

7. What thou art we know not;
What is most like thee?
From rainbow clouds there flow not
Drops so bright to see,
As from thy presence showers a rain of melody.

8. Like a poet hidden
In the light of thought,
Singing hymns unbidden,
Till the world is wrought
To sympathy with hopes and fears it heeded not;

9. Like a high-born maiden
In a palace tower,
Soothing her love-laden
Soul in secret hour
With music sweet as love, which overflows her bower;

10. Like a glow-worm golden,
In a dell of dew,
Scattering unbeholden
Its aërial hue
Among the flowers and grass which screen it from the view;

11. Like a rose embowered
In its own green leaves,
By warm winds deflowered,
Till the scent it gives
Makes faint with too much sweet these heavy-wingèd thieves.

12. Sound of vernal showers
On the twinkling grass,
Rain-awakened flowers,
All that ever was
Joyous and fresh and clear thy music doth surpass.

13. Teach us, sprite or bird,
What sweet thoughts are thine;
I have never heard
Praise of love or wine
That panted forth a flood of rapture so divine.

14. Chorus hymeneal,
Or triumphant chant,
Matched with thine, would be all
But an empty vaunt,—
A thing wherein we feel there is some hidden want.

15. What objects are the fountains
Of thy happy strain?
What fields, or waves, or mountains?
What shapes of sky or plain?
What love of thine own kind? What ignorance of pain?

16. With thy clear, keen joyance
Languor cannot be:
Shadows of annoyance
Never come near thee:
Thou lovest; but ne'er knew love's sad satiety.

17. Waking or asleep,
Thou of death must deem
Things more true and deep
Than we mortals dream,
Or how could thy notes flow in such a crystal stream?

18. We look before and after,
And pine for what is not;
Our sincerest laughter
With some pain is fraught;
Our sweetest songs are those that tell of saddest thought.

19. Yet if we could scorn
Hate and pride and fear,
If we were things born
Not to shed a tear,
I know not how thy joy we ever should come near.

20. Better than all measures
Of delightful sound,
Better than all treasures
That in books are found,
Thy skill to poet were, thou scorner of the ground!

21. Teach me half the gladness
That thy brain must know,
Such harmonious madness
From my lips would flow,
The world should listen then, as I am listening now.

SHELLEY.

COLLECTING IN CEYLON.

1. The first expedition on the Bay of Belligam convinced me that it abounded in pelagic animals of widely dissimilar classes. The jars into which the swimming inhabitants of the surface water were emptied from the gauze net were quite full after a few hours' fishing. Among thousands of infinitesimal crabs and *salpæ* floated delicate *medusæ* and *siphonophora;* multitudes of snail and mussel *larvæ* glided, by means of their dainty streamers, among fluttering sea-butterflies and *Pteropoda;* while hundreds of coral and crustacean *larvæ* were falling prey to rapacious arrow-worms. The majority of these organisms are colorless and of the crystalline transparency of the sea-water in which they struggle desperately for existence.

2. Although some of the species found here were new to me, I was familiar with most of the genera, for the prolific Mediterranean—especially the famous Strait of Messina—furnishes just such pelagic curiosities when the conditions are favorable for surface-water fishing. Still, among the old acquaintances I met with in the Bay of Belligam, I noticed a number of new and attractive forms that provoked immediate microscopic observation. Consequently I ordered my men to row quickly back to the shore, and while we were scudding through the water I devoted myself to an examination of my newly-acquired treasures. To my great disappointment I found at least half of

the delicate captives dead and dying; some were overtaken by death in half an hour, others in less than fifteen minutes after they were taken from the bay. Their crystal bodies speedily clouded, and formed a white powdery mass on the bottom of the jars, and before we reached the shore I could detect the peculiar odor which proceeds from gelatinous bodies in a state of decomposition. In the Mediterranean, under similar circumstances, death is not followed by decomposition until after a period of five to ten hours; here, with a higher temperature by several degrees it took place in half an hour's time. Alarmed by this discovery I hastened our return to the land, which we reached shortly before twelve o'clock. Here another difficulty presented itself: notwithstanding the mid-day sun's fierce heat, almost the entire population of Belligam was assembled on the strand to learn the result of my extraordinary method of fishing. Each one of the dusky throng wanted to see what I had caught, and wanted to know what I was going to do with it—or, rather, in what shape I was going to devour it; for, that sea-creatures were captured for any other purpose than a dietary one of course never entered their heads. Consequently the amazement of the inquisitive natives, among whom I made my way with great difficulty, was by no means small when they beheld merely the white sediment on the bottom of the large glass jars, and the few tiny pelagic creatures that were still actively disporting themselves in their new quarters. Afterward the Arachy, the second head man of Belligam, informed me that his fellow-citizens could not understand, or indeed believe,

that I was engaged in merely scientific work; most of them detected behind all this mysterious business some sort of witchcraft, the preparing of magic potions, etc., while the realistic Belligamians believed I was trying to invent a new curry. The still more enlightened were confident that I was simply a European lunatic.

3. Thus a valuable quarter of an hour was lost before I could force my way through the curious skeptics to the rest-house, and—as was my wont—to sort and distribute the thousand dainty creatures in glass vessels of fresh water. By this time at least nine-tenths of my treasures were dead, and among them the new ones whose forms had particularly interested me. The remaining tenth were already so exhausted that death seemed imminent at any moment, and in a few hours my jars were in fact nothing but huge receptacles for pelagic corpses! The following days I sought by every means to counteract the fatal influence of the tropical sun, but was only partially successful. It was simply impossible to maintain the necessary low temperature of the water. I was convinced that the first and most important requirements for the successful observation of marine fauna in so hot a country as Ceylon would be cool rooms and refrigerating water vessels. As large quantities of ice, which was formerly imported from North America, are now manufactured in Colombo by an artificial process at much less expense, it would not be a very difficult matter to arrange cool apartments, and refrigerated aquaria. But a considerable sum of money would be necessary for such a project, and that is not at my disposal. A second important requirement for

successful zoölogical study in these refrigerated work-rooms would be glass windows—conveniences which are almost entirely unknown in Ceylon.

4. In the rest-house at Belligam, as well as in all the dwellings on the island, their place is supplied by wooden shutters or jalousies, at the top of which, as well as along the edges of the ceiling, and above the doors, are wide spaces to admit the air. For the purpose of ventilation these openings are of course very practical and comfortable, but for the naturalist, who is obliged to use a microscope, they are as objectionable as detrimental. All sorts of winged and creeping insects have free ingress; the most troublesome are the swarms of flies, gnats, ants, and termites. Then the draught wafts your papers about, covers the instruments with dust, and frequently a more vigorous breeze displaces everything in the room. No less detrimental are the jalousies themselves to a good light, which is one of the most important requisites for microscopic examinations—especially when it is necessary to increase the magnifying power. Very often the condition of the sun and wind make it impossible for me to find a suitable corner for my work-table —either in the darkened room, or on the all-too-breezy veranda, whose wide projecting roof was also a decidedly objectionable feature.

5. To these and various other local obstructions to zoölogical study, may be added the annoyances arising from the curiosity of my neighbors. Never having seen any of the wonderful instruments I had brought to their village, the worthy Belligamians naturally wanted to know all about them, what they

were intended for, and how I used them. In short, everything I did was for them a continual source of amusement. Like all semi-civilized peoples, the Cingalese are in many respects mere children. Beneficent Nature has made the conditions of their paradisal island so favorable that the struggle for existence on it is comparatively easy, while actual toil is almost unknown. Innocent games and chatter form their principal amusements, consequently every new object becomes a source of interest. The too-frequent visits of my inquisitive neighbors at last became such an intolerable nuisance that I was obliged to speak of it to some of the more important personages in the village. Steps were at once taken to remedy the evil; the masses were excluded from the rest-house, but the visits of the important personages before mentioned became all the more frequent and of longer duration. The "doctor" was especially interested in my microscope; the "tax-gatherer" took a wonderful fancy to my paint-box; the "magistrate" professed great admiration for the anatomical instruments (as implements of torture, perhaps!); the "schoolmaster" liked to examine my books, and so on. Everything I owned was felt, tested, and examined a thousand times, and quite as many nonsensical questions asked about each article. Seeing how intensely curious my constantly increasing collections made the worthy Belligamians, I undertook to satisfy what I believed to be an earnest desire for information. At stated hours on certain days I delivered a series of formal lectures with copious illustrations—an expedient which had been employed with flattering success while

fishing on the Mediterranean—but my native audiences would not believe half I told them, nor would they try to understand what I took great pains to explain. I soon became convinced that the childish inquisitiveness of the Cingalese had not yet developed into a true desire for knowledge, and that the causative coherence of phenomena had very little attraction for these innocent children!

6. It would weary the reader were I to enumerate all the hindrances that opposed my zoölogical labors in the primitive laboratory at Belligam. Without the aid of a competent European assistant, I was obliged to depend entirely on my own exertions, and much valuable time was lost in the performance of extra work, which would not have been the case had I been engaged in a similar task on the European coast. Besides, the time I had to spend in Ceylon was entirely too short for the accomplishment of what I had originally intended: a series of coherent investigations of the history of evolution. Consequently, what I had at first deplored—that the number of new and peculiar sea animals in the Bay of Belligam was not nearly so large as I had expected—proved in the end a real consolation. The extensive marine investigations of the last twenty years (especially those conducted by the "Challenger" expedition) conclusively demonstrate, that the diversity of form among the inhabitants of the different oceans is nothing like so great as the difference between the inhabitants of the different continents. Of this fact my own investigations at Belligam were only additional proof. Of course I found a large number of new, and some very

interesting animal forms—chiefly among the lower divisions of marine fauna—*radiolarians*, *infusoria*, sponges, corals, *medusæ*, and *siphonophora*—but they only furnished further evidence that the fauna of the surface-water of the Indian Ocean, as well as that along its shores, was closely allied to the better-known sea-animal world of the tropical Pacific Ocean; for instance, Philippine and Fiji Islands.

7. If in spite of all hindrances I amassed a considerable zoölogical collection in Belligam, and brought back to Jena far more material for study than I can hope to master in the remaining years of my life, then I owe the greater part of it to the indefatigable zeal of my faithful Ganymede, whose highest ambition was to enrich my collection with land- and sea-creatures of all sorts. Through his influence a number of boys were engaged to collect for me, and the curiosity trade with these little fellows soon assumed a very pleasant as well as profitable character. At stated periods a whole army of nude graceful lads would wait on me at the rest-house. One dusky little god would bring a pair of exquisitely-tinted fishes, another a curious sea-star or sea-urchin, a third would offer a huge black scorpion or milliped, a fourth would display a pair of gorgeous butterflies or beetles, and so on. The entertaining scenes always recalled similar ones I had enjoyed on the Mediterranean shore, especially at Naples and Messina. But how different the behavior of the little traders here and there! The Italian boys extolled their wares in loud, noisy tones, and with native eloquence frequently delivered long and flowery speeches eulogistic

of their perfections. They asked ten times as much as the articles were worth, and were never satisfied even when I paid the exorbitant prices they demanded. On the other hand, the little Cingalese would shyly and respectfully lay their wares before me, and wait in silence to hear what I would offer for them. As a general thing they would be satisfied with a trifling coin, but they would be particularly delighted when I gave them any of the articles I had brought with me from Europe for bartering purposes.

8. Unfortunately I had neither time nor the appliances necessary to preserve all the interesting natural curiosities I collected in this manner. Here again the tropical climate and destructive insects presented insuperable difficulties—especially when I attempted to dry anything. To throughly dry organic substances in such a humid atmosphere is one of the most difficult problems, for even the very air is filled with moisture, and a specimen that is already dry will mould and slowly decompose. It is absolutely impossible to sufficiently dry many objects. Although I hung the skins of the birds and mammals I had shot and taken so much trouble to prepare in the sun for weeks, every night would thoroughly drench them with moisture.

9. More hostile still to the drying of natural curiosities than the humid atmosphere, are the legions of destructive insects. No place, no object, is safe from these pests. Even were there no chinks everywhere in the walls through which all sorts of creeping and flying beasties, as well as the humid air, have free ingress, it would still be impossible to protect one's self

from their attacks. Nothing can withstand the assault of their powerful jaws; they will force an entrance through anything—the walls, the roof, and the stone floor, which they skillfully undermine. Frequently on rising in the morning one is astonished to find conical heaps of earth which have been flung up between the flagstones during the night by the industrious termite, or ant sappers and miners. I was convinced of the energy and dispatch with which these minute enemies accomplish their work before the end of my first month in Belligam. I had accumulated in these four weeks a handsome collection of dried butterflies and beetles, skins of birds and mammals, curious fruits and specimens of woods, ferns, and other interesting plants, and locked them—securely, as I imagined—in a small side-room of the rest-house. Almost every day I visited my treasures, to see whether the enemy had made any inroads upon them, and took good care always to destroy the advance-guard of the termite and ant armies I might find reconnoitering on my territory. By generous applications of camphor, naphtha, and carbolic acid I imagined I had sufficiently protected my treasures to leave them for a few days, as an excursion to a distant point, and some urgent work, would require my attention for that length of time. How startled was I when at the end of the third day I entered my well-protected museum, and found most of my treasures transformed into heaps of dust and mould! A dozen regiments of large red ants had forced an entrance through the roof, several divisions of small black ants had entered through the walls, while a legion of termites had come up

through the floor, and made a combined assault that resulted most disastrously for my collection!

ERNST HAECKEL, "India and Ceylon."

THE REINDEER.

1. THE Reindeer may well be called the camel of the northern wastes, for it is a no less valuable companion to the Laplander or to the Samojede than the "ship of the desert" to the wandering Bedouin. It is the only member of the numerous deer family that has been domesticated by man; but though undoubtedly the most useful, it is by no means the most comely of its race. Its clear dark eye has, indeed, a beautiful expression, but it has neither the noble proportions of the stag nor the grace of the roebuck, and its thick square-formed body is far from being a model of elegance. Its legs are short and thick, its feet broad but extremely well adapted for walking over the snow or on a swampy ground. The front hoofs, which are capable of great lateral expansion, curve upward, while the two secondary ones behind (which are but slightly developed in the fallow-deer and other members of the family) are considerably prolonged: a structure which, by giving the animal a broader base to stand upon, prevents it from sinking too deeply into the snow or the morass. Had the foot of the reindeer been formed like that of our stag,

Reindeer in Norway.

it would have been as unable to drag the Laplander's sledge with such velocity over the yielding snow-fields as the camel would be to perform his long marches through the desert without the broad elastic sole-pad on which he firmly paces the unstable sands.

2. The short legs and broad feet of the reindeer likewise enable it to swim with greater ease—a power of no small importance in countries abounding in rivers and lakes, and where the scarcity of food renders perpetual migrations necessary. When the reindeer walks or merely moves, a remarkable clattering sound is heard to some distance, about the cause of which naturalists and travelers by no means agree. Most probably it results from the great length of the two digits of the cloven hoof, which when the animal sets its foot upon the ground separate widely, and when it again raises its hoof, suddenly clap against each other. A long mane of a dirty white color hangs from the neck of the reindeer. In summer the body is brown above and white beneath; in winter, long-haired and white. Its antlers are very different from those of the stag, having broad palmated summits, and branching back to the length of three or four feet. Their weight is frequently very considerable—twenty or twenty-four pounds; and it is remarkable that both sexes have horns, while in all other members of the deer race the males alone are in possession of this ornament or weapon.

3. The female brings forth in May a single calf, rarely two. This is small and weak; but after a few days it follows the mother, who suckles her young but a short time, as it is soon able to seek and to find

its food. The reindeer gives very little milk—at the very utmost, after the young has been weaned, a bottleful daily; but the quality is excellent, for it is uncommonly thick and nutritious. It consists almost entirely of cream, so that a great deal of water can be added before it becomes inferior to the best cow-milk. Its taste is excellent, but the butter made from it is rancid and hardly to be eaten, while the cheese is very good.

4. In summer the reindeer lives upon green herbs or the leaves of trees; in winter his only food consists of moss, and the most surprising circumstance in his history is the instinct, or the extraordinary olfactory powers, whereby he is enabled to discover it when hidden beneath the snow. However deep the *Lichen rangiferinus* may be buried, the animal is aware of its presence the moment he comes to the spot, and this kind of food is never so agreeable to him as when he digs for it himself. In his manner of doing this he is remarkably adroit. Having first ascertained, by thrusting his muzzle into the snow, whether the moss lies below or not, he begins making a hole with his fore feet, and continues working until at length he uncovers the lichen. No instance has ever occurred of a reindeer making such a cavity without discovering the moss he seeks. Judging from the appearance of the lichen in the hot months, when it is dry and brittle, one might easily wonder that so large a quadruped should make it his favorite food and fatten upon it; but toward the month of September the lichen becomes soft, tender, and damp, with a taste like wheat-bran. In this state its luxuriant and flowery rami-

fications somewhat resemble the leaves of endive, and are as white as snow.

5. Though domesticated since time immemorial, the reindeer has only partly been brought under the yoke of man, and wanders in large wild herds both in the North American wastes, where it has never yet been reduced to servitude, and in the forests and tundras of the Old World. In America, where it is called "caribou," it extends from Labrador to Melville Island and Washington Land; in Europe and Asia, it is found from Lapland and Norway, and from the mountains of Mongolia and the banks of the Ufa as far as Novaja Zemlya and Spitzbergen. Many centuries ago—probably during the glacial period—its range was still more extensive, as reindeer bones are frequently found in French and German caves, and bear testimony to the severity of the climate which at that time prevailed in central Europe, for the reindeer is a cold-loving animal, and will not thrive under a milder sky. All attempts to prolong its life in our zoölogical gardens have failed; and even in the royal park at Stockholm Hogguer saw some of these animals, which were quite languid and emaciated during the summer, although care had been taken to provide them with a cool grotto to which they could retire during the warmer hours of the day. In summer the reindeer can enjoy health only in the fresh mountain air or along the bracing sea-shore, and has as great a longing for a low temperature as man for the genial warmth of his fireside in winter.

6. The reindeer is easily tamed, and soon gets accustomed to its master, whose society it loves, at-

tracted as it were by a kind of innate sympathy; for, unlike all other domestic animals, it is by no means dependent on man for its subsistence, but finds its nourishment alone, and wanders about freely in summer and in winter without ever being inclosed in a stable. These qualities are inestimable in countries where it would be utterly impossible to keep any domestic animal requiring shelter and stores of provisions during the long winter months, and make the reindeer the fit companion of the northern nomad, whose simple wants it almost wholly supplies. During his wanderings, it carries his tent and scanty household furniture, or drags his sledge over the snow. On account of the weakness of its backbone, it is less fit for riding, and requires to be mounted with care, as a violent shock easily dislocates its vertebral column. You would hardly suppose the reindeer to be the same animal when languidly creeping along under a rider's weight, as when, unencumbered by a load, it vaults with the lightness of a bird over the obstacles in its way to obey the call of its master. The reindeer can be easily trained to drag a sledge; but great care must be taken not to beat or otherwise ill-treat it, as it then becomes obstinate and quite unmanageable. When forced to drag too heavy a load, or taxed in any way above its strength, it not seldom turns round upon its tyrant, and attacks him with its horns and fore feet. To save himself from its fury, he is then obliged to overturn his sledge, and to seek a refuge under its bottom until the rage of the animal has abated.

7. After the death of the reindeer, it may truly be

said that every part of its body is put to some use. The flesh is very good, and the tongue and marrow are considered a great delicacy. The blood, of which not a drop is allowed to be lost, is either drank warm or made up into a kind of black pudding. The skin furnishes not only clothing impervious to the cold, but tents and bedding; and spoons, knife-handles, and other household utensils are made out of the bones and horns; the latter serve also, like the claws, for the preparation of an excellent glue, which the Chinese, who buy them for this purpose of the Russians, use as a nutritious jelly. In Tornea the skins of newborn reindeer are prepared and sent to St. Petersburg to be manufactured into gloves, which are extremely soft, but very dear. Thus, the cocoa-nut palm, the tree of a hundred uses, hardly renders a greater variety of services to the islanders of the Indian Ocean than the reindeer to the Laplander or the Samojede; and, to the honor of these barbarians be it mentioned, they treat their invaluable friend and companion with a grateful affection which might serve as an example to far more civilized nations.

8. The reindeer attains an age of from twenty to twenty-five years, but in its domesticated state it is generally killed when from six to ten years old. Its most dangerous enemies are the wolf, and the glutton or wolverine (*Gulo borealis* or *arcticus*), which belongs to the bloodthirsty marten and weasel family, and is said to be of uncommon fierceness and strength. It is about the size of a large badger, between which animal and the pole-cat it seems to be intermediate, nearly resembling the former in its general figure and

aspect, and agreeing with the latter as to its dentition. No dog is capable of mastering a glutton, and even the wolf is hardly able to scare it from its prey. Its feet are very short, so that it cannot run swiftly; but it climbs with great facility upon trees, or ascends even almost perpendicular rock-walls, where it also seeks a refuge when pursued.

9. When it perceives a herd of reindeer browsing near a wood or a precipice, it generally lies in wait upon a branch or some high cliff, and springs down upon the first animal that comes within its reach. Sometimes also it steals unawares upon its prey, and, suddenly bounding upon its back, kills it by a single bite in the neck. Many fables worthy of Münchhausen have been told about its voracity; for instance, that it is able to devour two reindeer at one meal, and that, when its stomach is exorbitantly distended with food, it will press itself between two trees or stones to make room for a new repast. It will, indeed, kill in one night six or eight reindeer; but it contents itself with sucking their blood, as the weasel does with fowls, and eats no more at one meal than any other carnivorous animal of its own size.

10. Besides the attacks of its mightier enemies, the reindeer is subject to the persecutions of two species of gadfly, which torment it exceedingly. The one (*Œstrus tarandi*), called Hurbma by the Laplanders, deposits its glutinous eggs upon the animal's back. The *larvæ* on creeping out, immediately bore themselves into the skin, where by their motion and suction they cause so many small swellings or boils, which gradually grow to the size of an inch or more

in diameter, with an opening at the top of each, through which the *larva* may be seen imbedded in a purulent fluid. Frequently the whole back of the animal is covered with these boils, which, by draining its fluids, produce emaciation and disease. As if aware of this danger, the reindeer runs wild and furious as soon as it hears the buzzing of the fly, and seeks a refuge in the nearest water. The other species of gadfly (*Œstrus nasalis*) lays its eggs in the nostrils of the reindeer; and the *larvæ*, boring themselves into the fauces and beneath the tongue of the poor animal, are a great source of annoyance, as is shown by its frequent sniffling and shaking of the head. A pestilential disorder like the rinderpest will sometimes sweep away whole herds. Thus in a few weeks a rich Laplander or Samojede may be reduced to poverty, and the proud possessor of several thousands of reindeer be compelled to seek the precarious livelihood of the northern fisherman.

G. HARTWIG, "The Polar World."

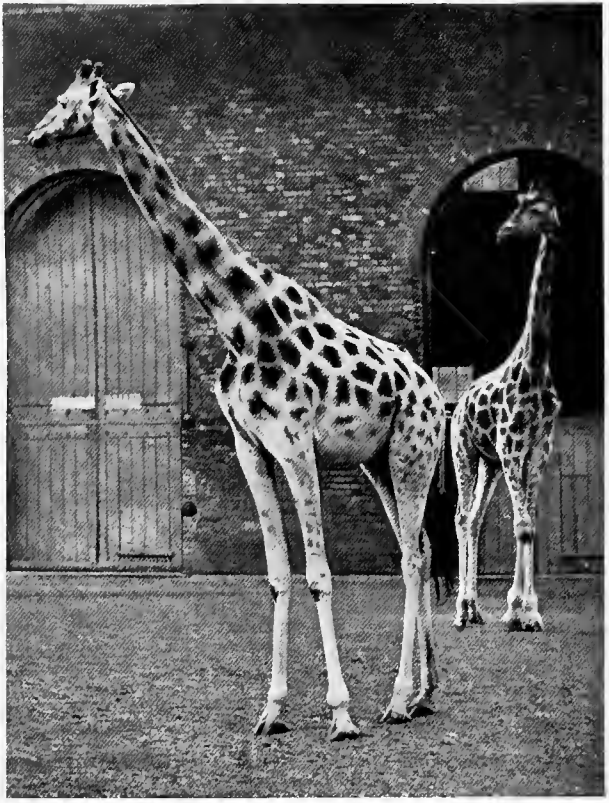
GIANTS AND PYGMIES.

1. NATURE presents everywhere the most opposite extremes. Birds have also their pygmies and their giants, their idlers and indefatigable workers. Their habits display, side by side, imbecility and intelligence, solitude and family life. Often in the tropical regions, where the sun darts his fiercest rays, we may

see flitting over the flowers brilliant birds, which sweep rapidly past like a spark of topaz or ruby; these are the humming-birds, living diamonds, slighter than some insects, and which often become the prey of huge spiders. The giant of this group scarcely attains the bigness of a sparrow, and the smallest hardly surpasses in size a humblebee. Hence, to the humming-birds, as they are commonly called, each speck of creation is a world. A simple leaf suffices for the gambols of a whole family; a flower is the perfumed throne on which the nuptials are accomplished, and the petals of its corolla spread out to form a velvet canopy which hides their chaste loves.

2. Were we to compare the size of different birds, we should arrive at wonderful results. Lacépède, who doubtless could not boast of being as exact as Archimedes, calculated that it would require a thousand millions of shrew-mice to equal a whale in weight. If that were true, we should also have to pile up some millions of humming-birds to weigh against the heavy ostrich, but it again is only a puny animal compared with two ornithological marvels, the discovery of which we owe to the illustrious zoölogists Prof. Owen and Isidore Geoffroy Saint-Hilaire. One of them, the gigantic Dinornis of New Zealand, a part of the skeleton of which is in the museum of the London College of Surgeons, was eighteen feet high. The bone of a man's leg is only a slender spindle compared to that of this colossal bird.

3. The disappearance of this monstrous animal dates from no very distant epoch, and everything attests that the first inhabitants of New Zealand were



Giraffes, or Camelopards.

perfectly acquainted with it. The ancient legends of the island tell us that at the time of its discovery it was full of birds of appalling size. There are also ancient poems there in which the father teaches his son how to hunt the Moa, the name belonging of old to this species; in these are described the ceremonies which took place when one had been killed. They feasted on the flesh and eggs, while the feathers served to adorn the arms of the vanquishers. Some hills are yet strewn with the bones of the Dinornis, the remains of these great feasts of the hunters.

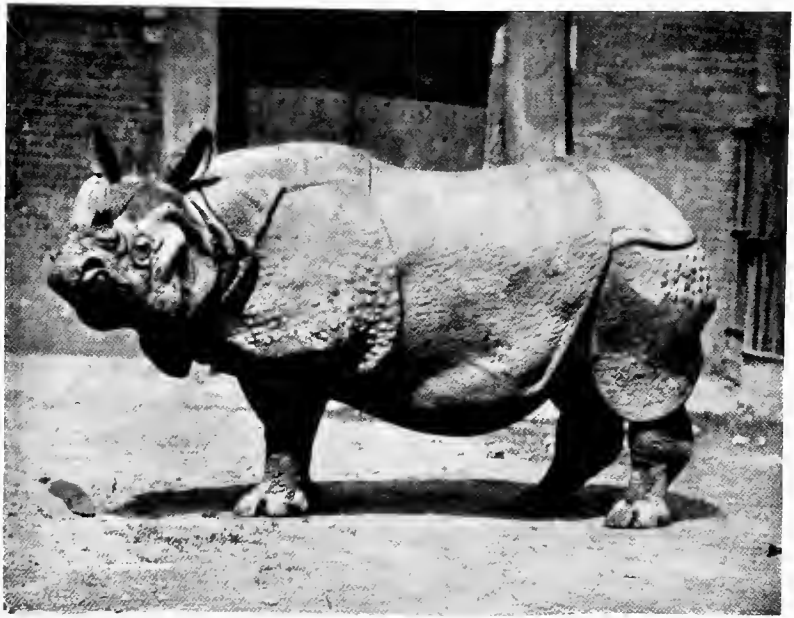
4. Another colossal bird, the Epiornis, which formerly lived in Madagascar, must have been of even greater size. One of its eggs, which is now in the museum at Paris, is six times as large as that of the ostrich, and it has been calculated that to fill the cavity would require twelve thousand humming-birds' eggs. Its shell, two millimeters thick, could only be broken by a blow with a hammer. What strength, then, must the beak of the young bird have possessed to be able to make a hole in it! What differences also in strength are found in birds!

5. When fleeing before the hunter, whose Arab steed presses it closer and closer, the alarmed and furious ostrich tears the soil of the desert, clinging to it, and leaving deep marks beneath each footstep, while it launches afar a cloud of sand and pebbles. When, on the contrary, a flock of humming-birds, attracted by the expanded and floating flowers of the Regia Victoria, play and gleam round them like a casket of topazes and rubies struck by the rays of the sun, neither the smooth surface of the lake nor the

beautiful flowers are in the least degree disturbed. And when one of these winged diamonds perches itself upon a petal of their virgin corolla, it does not even stir it. Again, when the fragile bird takes flight, its tiny claw has not injured the velvet softness of the flower. It might have lighted upon one of the twigs of the modest sensitive plant without this taking any alarm.

6. The secretary-bird, on the contrary—a powerful bird of prey belonging to Africa, incessantly occupied in combating reptiles, with one blow of its wing stuns a tortoise or a threatening serpent. The swan, with the same arm, can break a man's leg, or, as has been sometimes seen, dash him headlong into the water. The bearded vulture (*Gypaëtus barbatus*), some zoölogists tell us, attacks the hunters unawares in the dangerous passes of the Alps, and occasionally gives them a great deal of trouble. And the eagle in its bold flight carries children through the fields of air, and crushes them in the mountain precipices.

7. If we examine the form which our winged architects give to their nuptial couches, or the materials of which they build them, we see that they vary infinitely. Some birds, like the eagles and goshawks, which build their eyries in the midst of solitude and rocks, only employ in their construction rough fragments of stick heaped up in disorder; others make use of leaves and moss, which they arrange with skill. But such materials are still too coarse for the delicate bodies of the humming-birds, which pour along in swarms. They, as for example the saw-beaked humming-bird, often construct for themselves



The Indian Rhinoceros.

a downy charming little cup of cotton, wherein to shelter their jewelry of emeralds without sullying the luster of them. Other species of the same group, which also make use of soft pillows, garnish the outside of their nests with fragments of lichens, doubtless to hide it better from the animals of prey that live in the midst of the foliage. This is the case with the mango humming-bird—the black-plastron humming-bird of Buffon.

F. A. POUCHET, "The Universe."

THE BLOOD HORSE.

1. GAMARRA is a dainty steed,
Strong, black, and of a noble breed,
Full of fire, and full of bone,
With all his line of fathers known;
Fine his nose, his nostrils thin,
But blown abroad by the pride within!
His mane is like a river flowing,
And his eyes like embers glowing
In the darkness of the night,
And his pace as swift as light.

2. Look,—how round his straining throat
Grace and shifting beauty float;
Sinewy strength is in his reins,
And the red blood gallops through his veins:

Richer, redder, never ran,
Through the boasting heart of man.
He can trace his lineage higher
Than the Bourbon dare aspire,—
Douglas, Guzman, or the Guelph,
Or O'Brien's blood itself!

3. He, who hath no peer, was born
Here, upon a red March morn.
But his famous fathers dead
Were Arabs all, and Arab-bred,
And the last of that great line
Trod like one of a race divine!
And yet,—he was but friend to one
Who fed him at the set of sun
By some lone fountain fringed with green;
With him, a roving Bedouin,
He lived (none else would he obey
Through all the hot Arabian day),
And died untamed upon the sands
Where Balkh amid the desert stands.

BRYAN W. PROCTER.

EDIBLE INSECTS.

1. THE *crustacea* afford in the northern lobster, the spiny lobster of the tropics, and numerous kinds of shrimps and crabs, many choice bits for our larder. Whether, however, any of the insects, or their allies

the spiders, or even the worms, will ever afford food to civilized man is a matter of grave doubt. While the bulk of our animal food is given us by the vertebrated animals, the ox, sheep, fowl, and game being our main dependence, the mollusks afford us the delicious oyster which we shall never be able to give up, the less aristocratic clam, handed over to the Pilgrim Fathers by the Sagamores and their followers, the delicious though rare scallop and the quahaug, while mussels, snails, and whelks regale our transatlantic friends. Honey is universally sought, and that is an insect product, but the flesh of insects is, upon the whole, repugnant to our feelings. This is certainly unreasonable, for multitudes of the locust or grasshopper of the East are eaten by Arabs and the savages in other parts of Africa. We look with repugnance upon a roasted grasshopper, but an Arab is said to have expressed his abhorrence at our eating raw oysters. While in their sudden flights the grasshoppers cover the ground and eat up every green thing, the natives adopt the sensible course of devouring them in turn. The Bushman, who is no farmer, sings:

> "Yea, even the wasting locust-swarm,
> Which mighty nations dread,
> To me nor terror brings nor harm;
> I make of them my bread."

2. He collects them, according to Andersson, by lighting large fires directly in the path of their swarms. As the insects pass over the flames, their wings are scorched and they fall helplessly to the ground. They are also, he says, collected by cartloads when they have

retired to rest. "The locusts, after being partially roasted, are eaten fresh, or they are dried in the hot ashes, and then stored away for future emergencies. The natives reduce them also to powder, or meal, by means of two stones or a wooden mortar, which powder, when mixed with water, produces a kind of soup or stirabout. I have tasted locusts prepared in various ways, but I cannot say that I have found them very palatable. But they must contain a vast deal of nourishment, since the poor people thrive wonderfully on them." He also states that "the Cape Colony has been particularly subject to this dreadful scourge, which is invariably followed by famine. The inroads of the locusts are periodical; according to Pringle, about once every fifteen years. In 1808, after having laid waste a considerable portion of the country, they disappeared and did not return until 1824. They then remained for several years, but in 1830 took their departure." The locust is truly migratory, the undeveloped partially winged young moving from one region to another. He quotes from Barrow, who says that "the *larvæ* at the same time were emigrating to the northward. The column of these imperfect insects passed the houses of two of our party, who assured me that it continued moving forward without any interruption, except by night, for more than a month."

3. Of very similar habits is our red-legged grasshopper (*Caloptenus femur-rubrum*). It appears at intervals in immense swarms. In 1871 it was very destructive to grass in northern Maine, seriously damaging the hay crop. It has also swarmed in Canada.

Dr. Harris enumerates its visitations in New England in the last century when it devoured every green thing. The habits of this species are not well known, except that it appears in midsummer in the winged state. The wingless *larvæ* appear in June, and, as Harris recommends, hay crops should be mown early, before the insects fly in swarms. The last of summer they couple and lay their eggs in holes in the earth, where they are hatched in the spring.

4. As Harris suggests, this insect can only be kept under by concerted action on the part of farmers. "In the south of France the people make a business, at certain seasons of the year (probably in the autumn and late in the spring), of collecting locusts and their eggs, the latter being turned out of the ground in little masses, cemented and covered with a sort of gum in which they are enveloped by the insects." Various forms of drag-nets can be invented for collecting them in large numbers, and run, if necessary, through a field by horse power. The inventive genius of our farmers will easily suggest methods of gathering these insects by the bushel, when they can be thrown into hot water, and fed to swine. An entomological friend has found by his own experience that roasted grasshoppers are excellent eating—"better than frogs." Only let some enterprising genius of the kitchen once set the example of offering to his customers roasted grasshoppers, rare-done, and fricasseed canker worms (for we have it on the word of an entomologist that caterpillars are pleasing to the palate of man), and these droves of entomological beeves will perchance supplant their vertebrate rivals at the shambles, and

instead of cattle fairs, we shall have grasshopper festivals, and county caterpillar shows.

5. Of other insects eaten by man we may instance the humblebee, whose body is often sacrificed to the love of boys for sweets, who since Shakespeare's time have searched for the "well bestratted bee's sweet bag"; while in Ceylon bees are eaten bodily as food. Some kinds of ants are eaten by the Indians of the Gulf coast of Mexico. Sumichrast says that "the natives eat the females after having detached the thorax"; and Humboldt tells us that ants are eaten by the Indians of South America. Kirby speaks from his own experience: he says that "ants have no unpleasant flavor; they are very agreeably acid, and the taste of the trunk and abdomen is different." He refers to the fact that "in some parts of Sweden ants are distilled along with rye to give a flavor to the inferior kinds of brandy." Certain galls are esteemed in Constantinople for their aromatic and acid taste, and Réaumur says that the galls of the ground ivy have been eaten in France, but he thinks it doubtful if they ever rank with good fruits.

6. "Among the delicacies of a Boshies-man's table," says Kirby, "Sparrman reckons those caterpillars from which butterflies proceed. The Chinese, who waste nothing, after they have unwound the silk from the cocoons of the silkworm, send the chrysalis to table: they also eat the *larva* of a hawk-moth (*Sphinx*), some of which tribe, Dr. Darwin tells us, are, in his opinion, very delicious; and lastly, the natives of New Holland eat the caterpillars of a species of moth of a singular new genus, to which my friend,

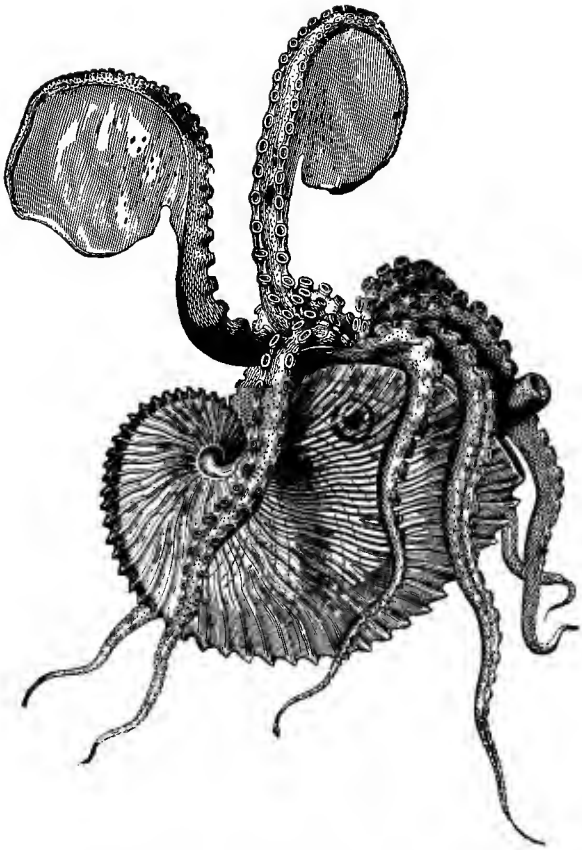
Alexander MacLeay, Esq., has assigned characters, and from the circumstance of its *larva* coming out only in the night to feed, has called it Nycterobius. A species of butterfly also (*Eublœa hamata*), as we learn from Mr. Bennett, congregates on the insulated granitic rocks in a particular district which he visited in the months of November, December, and January, in such countless myriads (with what object is unknown), that the native blacks, who call them Bugong, assemble from far and near to collect them, and, after removing the wings and down by stirring them on the ground previously heated by a large fire, and winnowing them, eat the bodies, or store them up for use by pounding and smoking them. The bodies of these butterflies abound in an oil with the taste of nuts; and when first eaten produce violent vomitings, and other debilitating effects; but these go off after a few days and the natives then thrive and fatten exceedingly on this diet, for which they have to contend with a black crow, which is also attracted by the Bugongs in great numbers, and which they despatch with their clubs, and use as food."

7. The cicada or harvest fly, to which Anacreon inscribes an ode, was eaten by the Greeks. Aristotle says that the *pupæ* are most delicious, and after they change to the winged state the males at first have the best flavor, while the females are better on account of the eggs. "Athenæus also and Aristophanes mention their being eaten; and Ælian is extremely angry with the men of his age, that an animal sacred to the muses should be strung, sold and eagerly devoured." Kirby, from whom we quote, cites Peter Collinson as saying

that the winged form of the seventeen year cicada was in his time (1763) eaten by the Indians of North America. Lastly, the gravid, enormously distended female of the white ant is regarded as a delicious morsel by the Hottentots, and Smeathman "thought them delicate, nourishing, and wholesome, being sweeter than the grub of the weevil of the palms."

8. Roasted spiders are eaten by the natives of New Caledonia. Kirby says that "even individuals among the more polished natives of Europe are recorded as having a similar taste, so that if you could rise above vulgar prejudices, you would in all probability find them a most delicious morsel. If you require precedents, Réaumur tells us of a young lady who, when she walked in her grounds, never saw a spider that she did not take and crack upon the spot. Another female, the celebrated Anna Maria Scherman, used to eat them like nuts, which she affirmed they much resembled in taste, excusing her propensity by saying that she was born under the sign Scorpio. If you wish for the authority of the learned, Lalande, the celebrated French astronomer, was, as Latreille witnesses, equally fond of these delicacies." Even the centipedes are not neglected, as Humboldt records the fact that "he has seen the Indian children drag out of the earth centipedes eighteen inches long and more than half an inch broad, and devour them."

9. Even the eggs of certain insects are eaten. In Mexico the eggs of the Corixa, or water boatman, are often used as food, and in the same country the Indians prepare a liquor from the Cicindela "by macer-



Argonaut, or Paper Nautilus.

ating it in water or spirit, which they apparently use as a stimulating beverage."

A. S. PACKARD, "Half Hours with Insects."

THE DEVIL-FISH.

1. AMONG the widely diversified class of marine creatures known as mollusks, there are none so interesting and captivating to the imagination as the cuttle-fish, squid, and other *cephalopods*, as they are called in science, from two Greek words, which in their combination mean "feet proceeding from a head," the most common form of which in our own seas is the octopus. Victor Hugo, in his remarkable novel of "The Toilers of the Sea," gives us a picturesquely terrible narrative of a conflict of his hero with one of these grewsome monsters of the deep. That portion of it which describes the octopus, under the name of *pieuvre*, or the devil-fish, the title given by the fishermen of the Channel Islands to this formidable creature, is worthy of quotation in this connection, though the poetic exaggeration of the novelist, justified by art purposes, can hardly be indorsed by science.

2. M. Hugo thus writes: "To believe in the existence of the devil-fish, one must have seen it. Compared to it, the ancient hydras were insignificant. Orpheus, Homer, Hesiod, only imagined the chimæra, Providence *created* the octopus. If terror was the object of its creation, it is perfection. The devil-fish

has no muscular organization, no breastplate, no horn, no dart, no tail with which to hold or bruise, no cutting fins or wings with claws; no prickles, no sword, no electric discharge, no venom, no talons, no beak, no teeth. It has no bones, no blood, no flesh. It is soft and flabby, a skin with nothing inside of it. Its under surface is yellowish, its upper earthy. Its dusty hue can neither be imitated nor explained. It might be called a beast made of ashes which inhabits the water. Irritated, it becomes violent. It is a spider in form, a chameleon in coloration. . . . Seized by this animal, you enter into the beast, the hydra incorporates itself with the man; the man is amalgamated with the hydra. You become one. The tiger can only devour you; the devil-fish inhales you. He draws you to him, into him; and, bound and helpless, you feel yourself slowly emptied into the frightful sac, which is a monster. To be eaten alive is more than terrible; but to be drunk alive is inexpressible."

3. Before the publication of Victor Hugo's description, which, making allowance for certain inaccuracies and overwrought notions, is sufficiently just to convey some true idea of the octopus, the knowledge of this animal among scientific men was limited. It had been known in a vague way since the time of Aristotle, but the remarkable stories which have come down to us had been treated by modern scientific men with contempt, as being mere legends, unworthy of credence or even of investigation. Pliny relates that an enormous cuttle-fish was taken on the coast of Spain which measured thirty feet long in its arms, and the body of which weighed seven hundred

pounds. Olaus Magnus and Denis de Montfort, naturalists during the Middle Ages, described a gigantic animal of the Northern Seas, under the name of the kraaken, which often made ships founder by its attack. Pontoppidan, Bishop of Bergen, in one of his books assures us that a whole regiment of soldiers could easily manœuver on the back of the kraaken, which he compares to a floating island.

4. The French steam corvette Alecton was once between Teneriffe and Madeira when she fell in with a gigantic calamar or squid, not less—according to the account—than fifty feet long, without reckoning its eight formidable arms, covered with suckers, and about twenty feet in circumference at its largest part, the head terminating in many arms of enormous size, the other extremity in two fleshy lobes or fins of great size, the weight of the whole being estimated at four thousand pounds; the flesh was soft, glutinous, and of reddish-brick color.

5. The commandant, wishing in the interests of science to secure the monster, actually engaged it in battle. Numerous shots were aimed at it, but the balls traversed its flaccid and glutinous mass without causing it any vital injury. But after one of these attacks the waves were observed to be covered with foam and blood, and, singular thing, a strong odor of musk was inhaled by the spectators. This musk odor is peculiar to many of the cephalopods.

6. The musket-shots not having produced the desired results, harpoons were employed, but they took no hold on the soft, impalpable flesh of the marine monster. When it escaped from the harpoon, it dived

under the ship, and came up again at the other side. They succeeded at last in getting the harpoon to hold, and in passing a bowling hitch round the posterior part of the animal. But when they attempted to hoist it out of the water the rope penetrated deeply into the flesh, and separated it into two parts, the head with the arms and tentacles dropping into the sea and making off, while the fins and posterior parts were brought on board.

7. Rev. Mr. Harvey, of Newfoundland, published an account a few years ago of the adventure of two fishermen in Conception Bay. Their boat passed near what appeared to be a floating bale of goods, which was presumed to be flotsam from some wreck. One of them struck the mass with the boathook, when it instantly opened, like a gigantic umbrella without a handle, and a huge head, with fiery, threatening eyes that protruded ominously, and a long, curved beak, raised itself from the surface. While they stood paralyzed with fear, the monster flung at them a tentacle of livid, corpse-like hue thirty feet long, which went far beyond the boat, or they would have been engulfed. One of the fishermen seized a sharp hatchet, and by a well-directed blow severed this terrible lasso before another one could be used, on which the savage apparition of the sea swiftly darted backward, and was lost to sight amid the ink-like discharge with which it blackened the waters. The tentacle was given to Mr. Harvey, and the fishermen avowed there must have been at least ten feet more of it next the body of their assailant. In this case, as in all the accounts of gigantic cephalopods, it is probable

that the creature belonged rather to the squid species, than what is properly known as the octopus.

8. The existence of these gigantic cephalopods became a matter of interest to scientific men after the publication of Victor Hugo's romance; and it has now become definitely established that the great squid is not only a verity, but one of the most formidable, in its equipment of attack and defense, produced by the immeasurable fecundity of the sea. If it existed in the same numbers as the shark, that ferocious and ravenous fish would be obliged to yield its prominence as the most dreadful denizen of the ocean waters. The octopus, and all its congeners, unlike other sea creatures, kill not merely for food, but appear to delight in killing for its own sake. True aquatic brigands, they are agressive and daring to an extreme degree, though their favorite mode is to lie in wait for their victims. Nature, however, applies to them the law of retaliation. All the cuttle-fishes, from the smallest to the largest, are favorite food of the whale and dolphin, which attack them with impunity. Michelet says: "These lords of the ocean are so delicate in their taste that they eat only the heads and arms, which are tender and easy of digestion. The coast at Royan, for example, is covered with thousands of these mutilated cuttle-fish. The porpoises take most incredible bounds, at first to frighten them and afterward to run them down; in short, after their feast they give themselves up to gymnastics."

9. Some very large specimens of the octopus have been captured. Professor Spencer Baird said that the large specimen which some years ago was pre-

served in the New York Aquarium was only an infant compared with the gigantic squid of the Pacific Ocean, that on which the sperm-whale is known to feed. One was cast ashore once at Newfoundland, with arms fifty feet long. Another was observed in Beaufort Harbor, in 1862, which measured thirty feet. Any one who has seen such a monstrous creature can readily conceive how it seizes its prey. The arms, eight, and in other cases ten, in number, form powerful pincers at their extreme ends, and are furnished the whole length with two rows of perfect sucking disks, or some two thousand air-pumps. The edges are also cut into sharp, saw-like teeth, hard as steel, which bury themselves in the flesh of the victim. Such a sized octopus as those described above could throw these terrible lassos at least twenty-five feet, and draw the body of a man to the mouth, when, with its iron-like beak, it could crush the helpless form and swallow, or drink it down, to use Victor Hugo's words.

10. The vulnerable portion of the octopus is the neck, and fishermen and others, who know their habits when attacked, always strive if possible to seize them by the throttle-valve, when they are easily killed. This is comparatively easy on land, but nearly impossible in the water. The locomotion of the devil-fish is as easy on land as in the water. They have been known frequently to run up perpendicular cliffs, two hundred feet high, as easily as the fly runs up a wall, the machinery of attachment being very similar. They are said to move on land as fast as a man can run, and frequently pursue their prey out of the sea,

though on the land they are far more timid than in their marine haunts.

11. The long appendages are used both as arms and legs. All of the octopods swim freely at will, and associate in numbers, but the larger ones, as they become older, fly from community life and retire into the clefts and hollows of the rocks which have been worn by the waves, generally in places only a few feet below the level of low water. There, with one arm clasped close to the wall of its dwelling, the watchful savage extends the others, alert, like the boa constrictor, for the approach of prey, and no less deadly in the crushing force of its folds. Its movements in seizing its victims are swift as an arrow. When the animal is swimming, its long tentacles would be in the way if extended or left pendant, so they are drawn close alongside and allowed to float behind, where they act as the tail to a kite. Motion in the water is gained by drawing in and expelling water from the locomotory tube. The octopus thus swims backward instead of forward. Its food consists of crustaceans, fishes, and other mollusks; every kind of animal, in fact, which comes within its reach. But it disdains carrion flesh, and feeds only on living victims. The general life of the octopus, as of the other cuttle-fish, is about five or six years; and it lays eggs, which are large and generally found in clusters. Fishermen call them sea-grapes.

12. One singular peculiarity the cuttle-fish, in its different varieties, shares with man. It changes color with anger, passing through various tints, and only resuming the usual hue when the emotion has ceased.

Not only does the octopus change color, but covers itself with pustules and excrescences when in a rage, increasing the repulsiveness of its appearance tenfold.

13. Mr. Beale, the naturalist, describes an adventure with a small octopus. He had been searching for shells among the rocks on Bonin Island, and was much astonished to see at his feet a most extraordinary-looking animal, crawling back toward the surf which it had just left. It was creeping on its eight legs, which, from their soft and flexible nature, bent considerably under the weight of its body, so that it was just lifted by an effort above the rocks. It appeared much alarmed and made every attempt to escape. Mr. Beale endeavored to stop it by putting his foot on one of its tentacles, but it liberated itself several times in spite of all his efforts. He then laid hold of one of the tentacles with his hand, and held it firmly, and the limb appeared as if it would be torn asunder in the struggle. To terminate the contest, he gave it a powerful jerk; it resisted the effort successfully, but the moment after the enraged animal lifted a head with large projecting eyes, and, loosing its hold of the rocks, suddenly sprang upon Mr. Beale's arm, which had been previously bared to the shoulder, and clung to it with its suckers, while it endeavored to get the beak, which he could now see between the tentacles, in a position to bite him. Mr. Beale describes its cold, slimy grasp as extremely sickening, and he loudly called to his friends, who were also searching for shells, to come to his assistance. They hastened to the boat, and he was released by killing his tormentor with a boat-knife, when the arms

were disengaged bit by bit. Mr. Beale says that this cephalopod must have measured across its expanded arms about four feet, while its body was not bigger than a large hand clinched. It was the species called the rock-squid by whalers.

ANONYMOUS, "A World of Wonders."

INTELLIGENCE OF THE ELEPHANT.

1. THE stories told by ancient writers concerning the sagacity of the elephant are, for the most part, less satisfactorily supported by testimony than those which are related by more modern authors. But they seem to show that the intelligence of the animal was almost as well known to the people of old times as it is to ourselves.

2. Looking into Pliny, we find him saying of the elephant that it is an animal distinguished for honesty, discretion, and a sense of justice, such as are rare even in mankind,—*quæ etiam in homine rara, probitas, prudentia, æquitas;* and that its understanding of what is communicated to it, its obedience to command, and retention of what it has learned, are marvelous. Respecting the docility of the elephants at Rome in his time, he relates that they would perform dances in concert, wield arms, and engage in gladiatorial combats; that they would walk on ropes, not only level, but sloping, and not only forward, but, what was more wonderful, backward; that four of them would

carry a fifth on a litter, like a sick lady; and that if one of them was invited into a dining-room full of guests, he would make his way to his couch with such carefulness of step as not to incommode any one of the company. As to their dancing, he tells the well-known anecdote of one, somewhat of the duller order, which, having been punished with stripes for not doing his lesson well in the day, was found practising it by himself at night; a story of which the truth has been much doubted, but Pliny says *certum est*,—there ought to be no doubt about it.

3. The anecdote is repeated by Plutarch, who adds that the animal was seen practising by the light of the moon. It may perhaps receive some support to its credibility from an account given of a jay by Mr. Jesse. A bird of that species belonging to a Somersetshire attorney, was an admirable mimic of sounds, but if it heard any new sound, as a strange kind of whistle or the like, would not attempt to imitate it while any one was within sight, but, having listened to it attentively, would try an imitation if he thought that he was not observed, and, if he succeeded, would display his new acquirement to the first person that passed him.

4. Pliny relates also that Mutianus, a man of eminence, who had been three times consul, used to say that he had seen an elephant that had learned to form Greek letters, in which he would write, *Ipse ego hæc scripsi, et spolia Celtica dicavi.* Mutianus was accustomed to relate also that he had seen some elephants landed at Puteoli, which, being frightened at the length of the temporary bridge between the ves-

sel and the shore, had sense enough to turn their tails toward it, and walk along it backward, so that they might not see the danger which they had to encounter.

5. Both Ælian and Plutarch relate the story of an elephant, which was defrauded of its food by its keeper, revenging itself on him. The man, in measuring out the animal's barley, purloined a portion of it, and then put stones at the bottom of the measure, so as to raise the corn to the brim. He thus deceived the owner of the elephant, but not the elephant itself, who, one day, as the man was boiling his meat, took up a quantity of sand in his trunk, and spirted it into the pot, inflicting on the rogue a very appropriate kind of punishment.

6. Ælian adds, from a writer named Agnon, another story of an elephant that was cheated of its food. It was kept at a house in Syria, and was daily defrauded by its keeper of the half of a measure of barley allotted for it by its owner. It submitted to the deprivation for some time, but one day, when the owner was present, and waiting for the animal to be fed, the keeper poured out the whole measure, when the elephant carefully separated the barley into two portions with its trunk, taking the one and leaving the other, thus making known, as clearly as was possible for a dumb animal, the keeper's dishonesty.

7. A similar anecdote of the elephant appeared some short time since in the public papers, but I have had it repeated to me also by a gentleman who had received it direct from persons in India well aware of its truth. The occurrence took place in the early part of the year 1863. A large and strong elephant was

sent to Nagercoil to assist in piling up timber, and the Dewan, the officer who despatched it, requested the wife of a missionary residing there to be good enough to see the animal fed with its allowance of rice, lest the keeper, who was suspected of not being over-honest, should abstract any portion of it. The animal was accordingly brought to the missionary's house for that purpose, and, for a time, all appeared to go on correctly; but at length the missionary's wife began to suspect that the quantity of rice was growing daily smaller and smaller. One day, in consequence, she intimated her mistrust to the keeper, who, with an air of the utmost sincerity, expressed his wonder that she should think there could be any ground for such an imputation against him, concluding by saying in his own native phraseology, "Madam, do you think I could rob my child?" During the conversation the elephant was standing by, and seemed by degrees to become perfectly aware that what was being said related to himself and his food. The keeper had on a very bulky waistcloth, which the elephant eyed from time to time, and just as the man concluded his protestations, and the missionary's wife was hesitating whether she should say anything more, the animal quietly threw his trunk round the keeper, and suddenly untied the waistcloth, when a large quantity of rice, which the man had secreted in it, fell to the ground. Here again we see sagacity and intelligence almost equal to that of a human being.

8. Let us throw together here a few other old stories concerning the perspicacity of elephants: An elephant at Rome that was ill-treated by a number of

boys, who pricked his trunk with their writing-styles, seized one of them, and raised him up over his head, intending, as the others expected, to dash him on the ground, but, while they were crying out in terror, he set him quietly down again, as if he thought he had sufficiently punished a child by giving him a severe fright.

9. A man who had a wife older than himself strangled her, in order to marry a younger woman, with whom he had fallen in love. But a tame elephant which he kept, and which saw the man commit the murder, took the new wife to the place where the other was buried, and turned up the earth with his tusks and trunk, till the body was completely exposed.

10. When a number of elephants, says Plutarch, are going to cross a river, they send in the youngest and smallest one first, while the others stand on the bank and watch whether the water is too deep for him, for, if it is not, they know that they can all cross with perfect safety. The same author relates that those who catch elephants in India sometimes dig pits to entrap them, covering them over with earth and brushwood, and that, if one of a herd happens to fall into such a snare, the rest will bring wood and stones and throw them in to fill up the bottom, till the captive is raised high enough to step out.

JOHN SELBY WATSON, "The Reasoning Power of Animals."

PHILOMELA.

1. Hark! ah, the nightingale!
The tawny-throated!
Hark! from that moonlit cedar what a burst!
What triumph! hark,—what pain!
O wanderer from a Grecian shore,
Still,—after many years, in distant lands,—
Still nourishing in thy bewildered brain
That wild, unquenched, deep-sunken, Old-World pain,—
Say, will it never heal?
And can this fragrant lawn,
With its cool trees, and night,
And the sweet, tranquil Thames,
And moonshine, and the dew,
To thy racked heart and brain
Afford no balm?

2. Dost thou to-night behold,
Here, through the moonlight on this English grass,
The unfriendly palace in the Thracian wild?
Dost thou again peruse,
With hot cheeks and seared eyes,
The too clear web, and thy dumb sister's shame?
Dost thou once more essay
Thy flight; and feel come over thee,
Poor fugitive! the feathery change
Once more; and once more make resound,

With love and hate, triumph and agony,
Lone Daulis, and the high Cephisian vale?
Listen, Eugenia,—
How thick the bursts come crowding through the leaves!
Again—thou hearest!
Eternal passion!
Eternal pain!

MATTHEW ARNOLD.

BARON CUVIER.

1. GEORGES CHRÉTIEN LÉOPOLD FRÉDÉRIC DAGOBERT CUVIER, the great French naturalist, was born at Montbéliard, August 23, 1769, and died in Paris, May 13, 1832. The family came originally from a village in the Jura which still bears the name of Cuvier; at the time of the Reformation it settled at Montbéliard, where some of its members held offices of distinction. The grandfather of Cuvier had two sons, the younger of whom entered a Swiss regiment in the service of France; a brave man and excellent officer, he rose to high honors, and at the age of fifty married a lady considerably younger than himself, and had three sons; the first died in infancy, the second was the subject of the present sketch, and the third was Frédéric Cuvier, also distinguished as a naturalist. As Georges had a delicate constitution, his mother watched over him with the tenderest care; she taught

him to read, made him repeat to her his Latin lessons, instructed him in drawing, and developed that ardent desire for knowledge which was so remarkable in him. At the age of ten he entered the gymnasium, where he remained four years, distinguishing himself in every branch there taught. At this early period his taste for natural history was stimulated by reading a copy of Buffon which he found at the house of a relative; and his memory was so retentive that at the age of twelve he was perfectly familiar with the descriptions of birds and quadrupeds. At fourteen he formed a kind of academy from among his schoolmates, of which he was president, at whose weekly meetings the merits of some book were discussed; here his oratorical and administrative powers began to manifest themselves. A petty trick of a malicious teacher prevented his being sent to the free school of Tübingen, where he would have prepared himself for the church; and this change in his studies he always regarded as most fortunate.

2. Charles, Duke of Würtemberg, took him under his special favor, and sent him to the academy of Stuttgart in March, 1784. After studying philosophy one year, he applied himself to the science of fiscal administration, because it gave him an opportunity to pursue his favorite natural history in books, in the fields, and in cabinets. One of the professors gave him a copy of the "System of Nature" by Linnæus, which was his library on natural history for several years. While occupied by such reading and the collection of specimens, he also obtained several prizes in his class studies. On leaving Stuttgart he became

private tutor in the family of Count d'Héricy in Normandy (July, 1788), where he remained till 1794. Here he pursued natural history with great zeal, being very favorably situated for the study of both terrestrial and marine animals. Some *terebratulæ* having been dug up in his vicinity, he conceived the idea of comparing fossils with living species. The dissection of some mollusks suggested to him the necessity of a reform in the classifications of animals; and here originated the germs of his two great works, the "*Ossemens fossiles*," and the "*Règne animal.*" Through his acquaintance with M. Tessier he began a correspondence with Geoffroy St. Hilaire, Lacépède, and other Parisian savants on subjects of natural history; and in the spring of 1795 he accepted their invitation to go to Paris, and was appointed professor in the central school of the Pantheon, for which he is said to have composed his "*Tableau élémentaire de l'histoire naturelle des animaux*," in which he first published his ideas on zoölogical arrangement. M. Mertrud had been appointed professor of comparative anatomy at the *Jardin des Plantes;* feeling himself unable from age to discharge all its duties, he called upon Cuvier to assist him, who at this time invited his brother Frédéric to join him, and commenced the collection of comparative anatomy which has since become so famous and extensive.

3. In 1796 the National Institute was formed, and Cuvier was associated with Lacépède and Daubenton in the section of zoölogy, and was its third secretary. The death of Daubenton at the close of 1799 made vacant for Cuvier the chair of natural history at the

Collége de France; and in 1802 he succeeded Mertrud as professor of comparative anatomy at the *Jardin des Plantes.* In 1802, appointed by Bonaparte one of the inspectors general to establish *lycées* or public schools, he founded those of Marseilles, Nice, and Bordeaux. He quitted this office in 1803 on being elected perpetual secretary to the class of natural sciences in the institute, a position which he held until his death; in this capacity he made in 1808 his celebrated report on the progress of the natural sciences since 1789, which appeared in 1800. In 1808 he was also made one of the councillors for life to the Imperial University, by which he was frequently brought into close communication with Napoleon. In 1809–'10 he was charged with the organization of the new academies in the Italian states annexed to the empire. In 1811 he was sent on a similar mission to Holland and the Hanseatic towns, and was made chevalier of the Legion of Honor. In 1813, though a Protestant, he was sent to Rome to organize a university there, and was also appointed master of requests in the council of state.

4. In 1814 he was named councillor of state by Napoleon, which honor was continued to him by Louis XVIII., as also that of royal commissary, which enabled him to introduce many improvements in criminal and civic law; and he was made chancellor to the university, which office he retained during life. In 1818 he visited England with his family, to observe its political and scientific institutions; while there he was elected a member of the French Academy. In 1819 he was made grand master of the university, and president of the *comité de l'intérieur*, and Louis

XVIII. created him baron. In 1822 he was appointed grand master of the faculties of Protestant theology, which gave him the superintendence of the religious, civil, and political rights of his creed; and in 1827 was added to this the management of the religious affairs of all the creeds in France except the Roman Catholic. In 1824 he acted as one of the presidents of the council of state at the coronation of Charles X., who in 1826 made him grand officer of the Legion of Honor. In 1830 he recommenced his lectures at the *Collége de France* on the "History and Progress of Science in all Ages," which were continued until his death; in this year he made a second visit to England, where he happened to be when the revolution occurred which placed Louis Philippe on the throne of France. He continued to enjoy all his honors and important offices under the citizen king; and in 1832 he was created peer of France, and the appointment of president to the entire council of state only wanted the king's signature when Cuvier expired.

5. On May 8, 1832, he opened his course of lectures at the *Collége de France.* After the first lecture he felt slight pain and numbness in the right arm, and his throat became affected; on the third day both arms were seized, and the power of swallowing was lost, all his mental faculties and the power of speech remaining unaffected; he was perfectly calm and resigned. Four hours before he died he was carried at his own request into the cabinet where the happiest and proudest hours of his life had been spent, and where he wished to draw his last breath. Feeble in his youth, by the time he arrived in Paris his health

was seriously deranged; but the excitement of new studies, the change in his habits, and the exertion of lecturing, worked such an alteration that he enjoyed good health until his final illness. He was below the middle stature, with very fair skin and reddish hair up to the age of thirty; as his health improved, his hair became darker; at forty-five he grew stout, but was always well; at sixty he scarcely seemed more than fifty; according to Duvernoy, he never used spectacles when reading or writing. Cuvier's brain was remarkably large, weighing between fifty-nine and sixty ounces, nearly a pound more than the average; the excess was caused almost entirely by the great development of the cerebral hemispheres, the seat of the intellectual faculties.

6. Besides the "Report on the Progress of the Physical Sciences," undertaken at the request of Napoleon, Cuvier displayed the extent of his acquirements by his reports before the Institute on meteorology and natural philosophy in general, chemistry and physics, mineralogy and geology, botany, anatomy and physiology, zoölogy, travels connected with natural science, medicine and surgery, the veterinary art, and agriculture. He contributed many articles on natural history to the "*Dictionnaire des sciences naturelles*"; prominent among these is the one on "Nature," in which he combats the metaphysical systems of pantheism and the physio-philosophers, and refers everything to the wisdom and goodness of an almighty Creator. He wrote many articles for a kindred work, the "*Dictionnaire des sciences médicales*," the most important of which is that on "*Ani-*

mal." As secretary of the Academy of Sciences it was his duty to read historical notices of deceased members at its public meetings; three volumes of these sketches have been published, containing thirty-nine articles. Besides these he delivered several discourses at funerals of academicians.

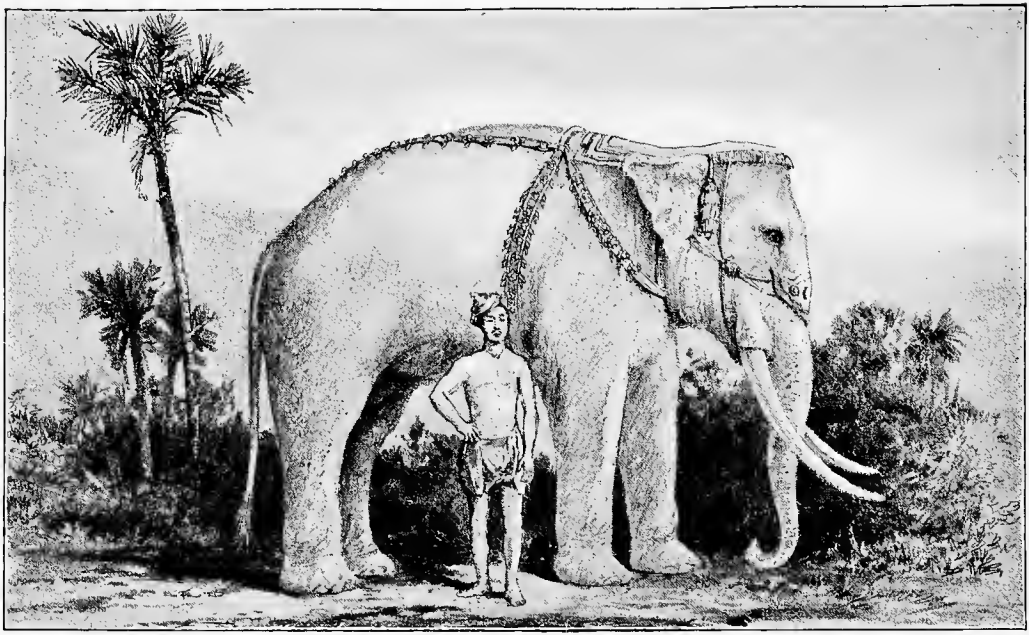
7. He was quite as eminent a legislator as naturalist, though less known as such; and, as royal commissary, councillor of the university, member of the state council, and president of the committee of the interior, he introduced beneficial changes in the municipal and provincial laws, and in public instruction. His language, both written and spoken, was clear, forcible, precise, and animated, frequently rising to the highest eloquence. The benignity and noble expression of his countenance was remarkable. In private, he was kind, affable, and ready to communicate information. He had the greatest love for order and regularity; he rarely allowed himself to be disturbed during the hours set aside for study, but during his hours of audience he was accessible to everybody. With his other accomplishments, he was an expert draughtsman; many of his plates were drawn by himself, and he left a large collection of designs intended to illustrate his unfinished work on comparative anatomy. The disinterestedness of Cuvier's character is shown not only by the acts of his life, but by the small fortune he left at his death; having filled offices of the highest trust, which he might have turned to his pecuniary advantage, he left only about $20,000 and a library which cost him a similar sum; this was purchased by government, and given to various institu-

tions, principally to the *Jardin des Plantes*. When we consider the number of offices he held, and whose duties he conscientiously performed, any one of which after his death was sufficient for a man of great talent, and some of which could not be as competently filled, we are able to form some idea of the varied acquirements, the unceasing industry, the wonderful memory, and the transcendent ability of Cuvier. By universal consent he is regarded as one of the best of men, most brilliant of writers, soundest of thinkers, most far-sighted of philosophers, purest of statesmen, and the greatest naturalist of modern times.

ANONYMOUS, "The American Cyclopædia."

WHITE ELEPHANTS.

1. THE first introduction I ever had to a white elephant was *apropos* of my audience with the King of Burmah, at Mandalay, his capital, during my travels through Farther India. King Mounglon, the father of the notorious Theebau, was then upon the Burmese throne. The audience chamber was arranged somewhat theatrically. A green baize curtain descended from ceiling to floor. A few feet above the floor this curtain presented a proscenium-like opening, ten feet square, which brought into view a luxurious alcove. Within this alcove His Majesty was seated upon the floor, resting against a velvet cushion, with a



The Sacred White Elephant.

cup, a betel-box, a carafe, a golden cuspidor, and a pair of silver-mounted binoculars within reach. He was short, stout, fifty-five, and pleasant, though crafty-looking. He was dressed in a white linen jacket and a silk cloth around the hips and legs. After staring at me a shocking long while through his binoculars, he became interested to an unseemly extent in my age, my father's business, my design in traveling, and other personal matters.

2. First, he made up his mind that I was a downright spy; then he concluded that I was a political adventurer; finally, it slowly dawned upon him that I was traveling simply for pleasure, and perhaps it was with the benevolent desire of enhancing that pleasure to the utmost that he offered me an unlimited number of wives (I did not inquire whose) on condition that I would permanently settle there. Happily the puritanical principles in which I had been educated enabled me to withstand the shock. St. Anthony could not have behaved better in the circumstances than I did; and, besides, St. Anthony's temptations merely existed in the abstract, while mine were almost within grasp. Perhaps I ought to add that I did not feel like entering the King's service just at that time. While refusing all his kind offers, through an interpreter—and His Majesty offered me a palace and a title, as well as a fortune, in addition to a harem practically infinite—I succeeded in mollifying him with the present of a handsome magnifying-glass, which I had taken with me from Calcutta for the express purpose. This glass had a bright gilt rim and an ivory handle. Though it passed into the King's hands then and there, I have

ever since seen through it everything that is good in Burmah.

3. It was while the glow of this visit was fresh upon me that I descended to the royal court-yard and there found, in a sort of palace by itself, a specimen of the sacred white elephant of which the world has heard so much and seen so little. The creature was of medium size, with whitish eyes. Its forehead, trunk, and ears were spotted with white, and looked as though their natural color had been removed by a vigorous application of pumice-stone or sand-paper. The remainder of the body was of the ordinary dark hue, so that it was impossible for me to say that I was contemplating a white elephant *par excellence*. The animal stood, I wish I could say, in milk-white majesty; but to tell the truth, its majesty was somewhat mouse-colored. It received me beneath a great embroidered canopy, a fetter on one of its forelegs being the only obvious symbol of captivity. This holy elephant had an intensely vicious look, so that I was fain to hope that behind a frowning providence it hid a smiling face. Umbrellas in gold and red occupied adjacent nooks in company with Roman-like fasces and silver-tipped spears and axes. The floor was networked with silver. Water jars and eating troughs, also of silver, were at hand to relieve its thirst and hunger.

4. Fresh-cut grass and bananas are its staple diet, though it also delights in rice, sugar-cane, cocoanuts, cakes, and candies. The water it drinks is perfumed with flowers or tinctured with palm wine. The average daily food it consumes reaches the modest weight of two hundred pounds. Instead of its name, as we

would place that of a valuable and favorite horse, a description of the animal, painted on a red tablet, was hung over one of the pillars of its stall. It ran as follows: "An elephant of beautiful color; hair, nails, and eyes are white. Perfection in form, with all signs of regularity of the high family. The color of the skin is that of the lotus. A descendant of the angels of the Brahmans. Acquired as property by the power and glory of the King for his service. Is equal to the crystal of the highest value. Is of the highest family of all in existence. A source of power of attraction of rain. It is as pure as the purest crystal of the highest value in the world."

5. The constant companions of the pale proboscidian whose acquaintance I made, and, indeed, of all that variety, are white monkeys. Both the Burmese and the Siamese believe that evil spirits may be thus propitiated. As it is necessary to guard the white elephant from superhuman assault and influence, several white monkeys are generally kept in its stables. These monkeys are not reverenced for themselves, but for the protection—especially protection from sickness—which they are supposed to give to their gigantic comrade. They are generally large, ugly, long-tailed baboons, thickly covered with fur as white as that of the whitest rabbit. As a rule, they are in perfect health and veritable demons of mischief. Captured more frequently than the white elephant, they enjoy about the same privileges as it, having households and officers of their own, but they are always obliged to yield it the precedence. There is encouragement to Darwinians in the Siamese saying that the white mon-

key is a man and a brother—I might almost say a man and a Buddha. Upon that principle, civilized man, instead of being a little lower than the angels, is a little higher than the apes.

6. Is the white elephant white, or only so by a figure of speech? To this question it is impossible to answer yes or no. The Siamese never speak of a white elephant, but of a *chang pouk* or strange-colored elephant. The hue varies from a pale yellowish or reddish brown to a rose. Buffon gives it as ash-gray. Judging from the specimens which I have seen, both at Mandalay and Bangkok, I should say it was generally a light gray, with spots or splashes of pink. The color of the true white elephant has that delicate shade which distinguishes the nose of a white horse. It has always a tinge of pink in it—that is to say, it is flesh-colored. The face, ears, front of trunk, breast and feet, have a sort of pinkish mottled appearance, while the remainder of the body is of an ashen color. It should always be remembered that the term "white," as applied to elephants, must be received with qualification. In fact, the grains of salt must be numerous, for the white elephant is white only by contrast with those that are decidedly dark. A mulatto, for instance, is not absolutely white, but he is white compared with a full-blooded negro. The so-called white elephant is an occasional departure from the ordinary beast. As there are human albinos, so there are elephantine albinos. And there is a general resemblance of characteristics among all quadrupedal albinos.

7. It is not alone the amount of pink or flesh color

that constitutes a white elephant. This animal must possess certain other peculiarities. Prominent among these are the color of the eyes, the redness of the mouth, and the white or light-colored nails. In this species also the hair, which is for the most part yellowish, is apt to be scanter and shorter than in other elephants; hence the skin, with its peculiar neutrality of tint, shows more plainly. When pink patches appear, they are due to the absence of dark pigment in the epidermis—at least this is the explanation of Prof. Flower, President of the Zoölogical Society of London. The same theory accounts for the light-colored hair. The iris is often red, sometimes pale yellow, sometimes pure white. When the latter is the case, the eyes are white-rimmed. Sometimes, too, a pink iris is visible in an eye that is rimmed with scarlet. I have heard it said, also, that the pupil is occasionally a bright red, though I have never seen this phenomenon. By the dissection of white dogs, white owls, and white rabbits, it has been discovered that the red color of their eyes is caused by the absence of dark pigment. To put the case in technical terms, the *pigmentum nigrum* of the choroid coat, and also that portion of it which lies behind the iris, and is called *uvea* by anatomists, is wanting.

8. The peculiar fairness of the skin and hair is said by those who differ from Prof. Flower to be brought about by the absence of a membrane called *rete mucosum*. An albino elephant sees with difficulty in a strong light, but, on the other hand, sees better in the dark than black elephants do. I do not know that a scientific attempt has ever been made to

formulate the freaks of Nature, so as to produce white elephants *ad libitum*. I am inclined to think, however, that even the most intelligent Burmese or Siamese are not sufficiently conversant with Darwin's "Variation of Animals and Plants under Domestication" to attempt much in this line. This variety of stirpiculture will probably be left to the future.

9. It is the general impression that white elephants are specifically different from others, but this is not the case. That they are distinguished from those species that have the ordinary color, by weakness of body, deficiency of instinct, or atrophy of mind, is abundantly refuted by facts. They are of ordinary size and shape, and specimens of both sexes are captured. When you possess an elephant whose color is that of a negro's palm, you possess a white elephant, the color not being necessarily hereditary, but caused by conditions so elusive that we are obliged, as a matter of convenience, to name the result a freak of Nature. The hue is never a consequence of disease. Under identical conditions white elephants and black elephants are equally long-lived. Whatever in each species be the difference in shade, or whether the animal be found roaming in the forests of Laos or residing in royal state in the cities of Mandalay or Bangkok, I must not forget to say that the absolutely white elephant—white as pure snow is white—is never seen. As an ideal it may be imagined as enjoying a lonely paradise in some yet undiscovered jungle.

10. In Farther India there are occasionally to be found ordinary black or dark-gray elephants which are afflicted with a skin disease termed by dermatologists

and zoölogists *leucoderma*. These elephants, at a distance, somewhat resemble the albinos, but a nearer inspection always shows that their eyes have neither a red, yellow, nor white iris; nor have their pinkish spots a sharp outline, but fade gradually into the surrounding hide. In these respects they strikingly differ from the albino variety. The greatest variation, however, is noticeable in their respective valuations, the genuine sacred white elephant in Burmah and Siam not being purchasable from anybody, by anybody, upon any terms; whereas the skin-diseased animal may be found without very arduous search, and may be readily purchased for five hundred rupees (two hundred and fifty dollars) or less. Notwithstanding this superlative distinction, ingenuous showmen have been known to so confuse these two varieties of elephants as even to exhibit the latter for the former.

FRANK VINCENT, "In and Out of Central America."

MARVELS OF INSECT ORGANIZATION.

1. THE torch of anatomy has shed a flood of light upon the organization of the inferior animals, and the microscope, by allowing us to pry into the most inaccessible nooks of it, has unfolded before our eyes a horizon as vast as it was unexpected. But it must be admitted, that if the investigation of infinitely small beings has acquired such an advanced degree

of certainty, it owes it to men who have often devoted all their lives to the object.

2. An advocate of Maëstricht, Lyonet, passed nearly all his life in studying a caterpillar which gnaws the wood of the willow, and produced on this insect only one of the most splendid monuments of human patience. Goedart, a Dutch painter, spent twenty of his best years in watching the metamorphoses of insects—a most interesting spectacle for him who looks at it with the eye of religion. Hence, in the midst of our most brilliant parties (into which affliction will yet make its way despite both pomp and gold), he felt tempted to exclaim, "Ah! let me rather see a butterfly born. In his puniest creatures God reveals his power and majesty; you, in your splendid *fêtes*, often display only your weakness and misery!"

3. Anatomically and physiologically speaking, the human mechanism is very rude and coarse, compared to the exquisite delicacy revealed in the organism of certain animals. But in us the intellect, the real scepter of the universe, predominates over the apparent imperfection of matter. Through it man alone approaches those chosen creatures who shine near the throne of the Eternal, and form a bond of union between heaven and earth; if in his structure he belong to our sphere, he seems already to elevate himself toward the supreme Essence by the splendor of his genius. This is a grand and philosophic truth, which a glance at the organization of insects will instantly demonstrate.

4. In her slightest sketches Nature knows how to

unite power to an exquisite fineness of mechanism; the first glance at insects proves this, and thus so soon as their interesting history is displayed before us, we feel no longer tempted to treat them with the disdain that poets have shown. A simple butterfly, a single fly, humbles the pride of man, and despite of him levels his forests, devours his crops, and reduces him to despair. An insect of this kind, unknown to him who apostrophizes it with contempt, petrifies the countryman with terror, while its sting is death to him!

5. Simple little, two-winged flies, gnats, and mosquitoes, the puny look of which would never lead one to dread aggression from such a quarter, are nevertheless enemies of the most inconvenient kind to our species. In some countries, where they swarm by myriads on all sides, man is subjected to their empire, and only avoids their attacks by adapting his abode and manner of living to the emergency. At the same time when the mosquitoes are most prevalent in Senegal, the negroes, notwithstanding the constraint of such a kind of life, remain constantly enveloped in the midst of thick smoke. For this purpose they set up regular roosts formed of branches, and suspended above masses of wood which burn perpetually beneath them. Squatted on these they receive their friends during the day, and at night, heated from below and smoked on all sides, they stretch themselves on them in order to sleep.

6. Some savage races only free themselves from the onslaughts of this accursed brood by smearing their bodies with a filthy covering of grease; and it is to protect himself against them that the miserable Lap-

lander condemns himself to be smoked all day long in his dark hut. The companions of the astronomer Maupertuis were so tormented by the stings of the mosquitoes during their travels in Lapland, that to free themselves from them they had recourse to the extreme measure of covering their faces with tar. Does the reader believe that these people treated insects with the same disdain as the poets, who did not in any way understand them?

7. A simple fly in Africa does still more: it disputes the land with us foot by foot; there is a struggle between man and it as to which shall have possession. Where it lives it prevents him from carrying on agriculture, and limits his explorations; he can only become master of the soil when he has exterminated it. This fly, generally called *tsetse* by the natives, is shaped like our common species, and seems to all appearance equally inoffensive, but its mouth secretes a venom the activity of which by far surpasses that of the most redoubtable serpents. It only requires a few of its stings to overwhelm the strongest ox; and yet if we attempted to ascertain the weight of its deadly agent by means of the most delicate balance, it is so small that we should perhaps find the calculation impossible.

8. It is an inexplicable anomaly that this fly, which inevitably kills certain animals, does not injure others. It selects all its victims from our cattle; the goat and the ass alone defy its sting. Nor do its attacks produce any effect upon man and wild animals. But what is still more singular, this dipterous insect kills the adult animal, but sucks the blood of its off-

spring without doing any mischief. The tsetse quickly poisons cattle, but produces no effect upon the calf. Livingstone says that during his wanderings his followers were frequently stung by it, without ever suffering in the least degree; in fact they paid no attention to it; while the deadly fly killed forty-three oxen in spite of the strictest watch.

9. In the domain of the infinitely little the physiological phenomena astonish us no less than the extreme slightness of the motive organs! A single comparison will demonstrate this. When we communicate an elevating movement to our arms, and suddenly bring them back to the body, a second of time will scarcely suffice for the act; but, according to the experiments of Herschel, some insects vibrate their wings several hundred times in this short period! M. Cagniard-Latour affirms that a gnat vibrates its wings five hundred times in a second. Mr. Nicholson goes still further; he asserts that the vibrations of the wing of the common fly are as many as six hundred in a second, since it passes through space at the rate of six feet in this time. But this observer adds, that for rapid flight we must multiply this number by six, which means that in a second, or the time we require to execute a single movement of one of our members, the fly with its wing can perform thirty-six hundred. The mind is stupefied at such calculations, and yet they are of unimpeachable accuracy! This marvelous rapidity of movement in the wings of insects explains the astonishing ease with which they fly. As M. Blanchard says, " In our days the railway traveler, carried at full speed, often amuses himself by watching from the

window the movements of the gnats that flit about with incomparable ease. These puny flies, notwithstanding the agitation of the air, dart backward and forward, wheel, rise, sink, and continue their gyrations for hours at a time, as if they were there to show us that the greatest speed we can attain is trifling compared to the power of their delicate wings."

10. After this we are no longer astonished at the activity shown by some butterflies, such as the sphinx, when they rifle the flowers of our gardens. They flit from one to the other with the speed of an arrow, and, like the humming-birds, they hang motionless before the corolla, plunging their long tongues to the bottom in order to sip the nectar, while their wings are agitated by movements which the eye cannot follow! The delicacy of the aërial oars is not less remarkable than their movements. However gently we take hold of the wing of a butterfly, our fingers never leave it without having some particles adhering, which seem only a fine dust, the source of the magnificent coloring of the insect. But when this dust is submitted to microscopic examination, the observer is surprised to see that each of these grains represents a little flattened plate, lengthened out and of a fine complicated structure, which reflects the most magical colors. One of its extremities is generally toothed more or less deeply, while the other displays only a little pedicle by which each imperceptible scale is attached to the transparent membrane of the wing. If a portion of this be now examined by the aid of a low magnifying power, it will be seen that all the scales are arranged with admirable symmetry, one above the other like the

tiles on a roof, and as they are of uniform shape and often of very varied colors, the surface of the wing closely resembles a mosaic of marvelous fineness, not like that of our artists, but like the result of divine art.

11. Our varied movements are executed by the aid of voluminous fleshy muscles attached to the skeleton. In respect to these the insect possesses both a numerical and a dynamical superiority over the human race. Anatomists calculate that there are only three hundred and seventy of these muscles in man, while the patient Lyonet discovered more than four thousand in a single caterpillar.

12. Insects equally surpass us in respect to strength. A man of average physical powers cannot move without difficulty a weight of forty-four pounds, placed horizontally. As he himself weighs from one hundred and fifty to two hundred pounds, he only moves in so doing a mass the weight of which does not equal a third of that of his body. If we subject a mole-cricket to the same test, the results are quite extraordinary. This creature, which only weighs sixty-one grains and three-quarters, can with its two large hands move a weight of about three pounds five ounces, which means that it displays a strength three hundred and seventy-five times exceeding its own weight! The most superficial observation serves to show the extraordinary strength possessed by insects. Sir Walter Scott has related that a garden-snail placed under a candlestick moved it from its place by the efforts it made to regain its liberty; the same thing, as Sir Walter says, as if a prisoner in Newgate were to shake the prison walls by his efforts to escape.

13. Notwithstanding their minuteness and the delicacy of their anatomy, some other insects also exhibit a comparative strength which astonishes us. Although it is almost puerile to speak of the flea, still we may take it for an instance, as it is unfortunately known everywhere. M. de Fonvielle, in his interesting work on the "Invisible World," maintains that it can raise itself from the ground to a height equal to two hundred times its stature. At this rate, he says, a man would only make a joke of jumping over the towers of Notre-Dame and the heights of Montmartre; and a prison would be an impossibility unless the walls were built more than a quarter of a mile in height.

F. A. POUCHET, "The Universe."

THE CRICKET.

1. LITTLE inmate, full of mirth,
Chirping on my kitchen hearth,
Wheresoe'er be thine abode
Always harbinger of good,
Pay me for thy warm retreat
With a song more soft and sweet;
In return thou shalt receive
Such a strain as I can give.

2. Thus thy praise shall be expressed,
Inoffensive, welcome guest!
While the rat is on the scout,
And the mouse with curious snout,

With what vermin else infest
Every dish, and spoil the best;
Frisking thus before the fire,
Thou hast all thy heart's desire.

3. Though in voice and shape they be
Formed as if akin to thee,
Thou surpassest, happier far,
Happiest grasshoppers that are;
Their's is but a summer's song,—
Thine endures the winter long,
Unimpaired and shrill and clear,
Melody throughout the year.

4. Neither night nor dawn of day
Puts a period to thy play:
Sing then—and extend thy span
Far beyond the date of man.
Wretched man, whose years are spent
In repining discontent,
Lives not, aged though he be,
Half a span, compared with thee.

COWPER.

CONCERNING SERPENTS.

1. FEW animals are more universally feared and detested than serpents. Their presence startles us, however inoffensive they may be. Nor can the grace-

fulness of their motion, or beauty of color, conquer the discontent we feel when we see them gliding in our path, or coiled and glistening in the sunshine, in which they delight. The enjoyment of many a summer's ramble has been impaired from this cause, and we fear our article may be as distasteful to many persons as are the objects of which it treats. But we may remember that serpents, no less than more attractive creatures, are important in Nature's economies. Their structure is a marvel of mechanical adaptation, less complicated, perhaps, but as perfect in every detail as is that of mammals and birds, and the mechanism which rolls the human eye is not more complete, and scarcely more wonderful, than that which moves the fangs of a viper. Perhaps, in the study of Nature, we should estimate objects by their fitness, rather than by their attractiveness or beauty.

2. "The serpent," observes Prof. Owen, "is too commonly looked down upon as an animal degraded from a higher type. . . . But it can outclimb the monkey, outswim the fish, outleap the jerboa; it has neither hand nor talons, yet it can outwrestle the athlete, and crush the tiger in its embrace." Serpents, in their mode of locomotion, are creeping animals, as their name implies, and constitute an order of the great class Reptiles. This term also implies creeping, but includes orders of animals which have limbs for locomotion, and do not creep. Of these, turtles, lizards, and crocodiles, are familiar instances; so that animals of several species, which run, walk or swim, are included in the same class with those which creep. All of these, however, are cold-blooded, the

temperature of the body differing but few degrees from that of the surrounding air or water. Their coldness is always obvious to the touch, and this is true with those found in hot as well as in temperate climates, and adds greatly to their repulsiveness.

3. Of serpents, their general form and structure are the same. Their bodies are rounded and elongated, and covered with a scaly skin. The vertebral column is continuous with the length of the body, and is divided into joints from two hundred to four hundred in number, but in the large pythons, as stated by Dr. Carpenter, four hundred and twenty-two joints have been counted. To about three hundred and sixty, or six-sevenths of these, were attached pairs of movable ribs. A rattlesnake, with one hundred and ninety-four vertebræ, had one hundred and sixty-eight pairs of ribs. The vertebræ of the serpent are united by a most perfect ball-and-socket joint, and the ribs are joined to the vertebræ in a similar manner. These, held and worked by complete muscular adjustment, give to several their wonderful flexibility, strength, and crushing power. The structure of the backbone of a serpent has direct relation to its locomotion, for it is without limbs, and rudiments of pelvic bones are found only in the boas, pythons, and a few other species. But, where the type shades off into allied reptilian forms, the rudimental limbs are developed and prominent.

4. We read that the curse pronounced upon the serpent was, "upon thy belly thou shalt go," and the inference seems to be that, previous to that time, its mode of progression was not upon its belly. This

would imply a great anatomical change in the structure of the creature at the time in question, a change which, so far as we are aware, is not proved by paleontological research, and the expression is probably a figurative one, as observed by Dr. Buckland. Serpents progress by the "foldings and windings they make on the ground," and the stiff, movable scales which cross the under portion of the body; but the windings are sideways, not vertical.

5. The structure of the vertebræ is such, that upward and downward undulations are greatly restricted, and many illustrations, showing sharp vertical curves of the body, are exaggerations. Most persons have seen snakes glide slowly and silently, without any contortion. They seem to progress by some invisible power; but, if permitted to move over the bare hand, an experiment easily tried, a motion of the scales will be perceived. These are elevated and depressed, and act as levers, by which the animal is carried forward. Nor can a serpent progress with facility on the ground, without the resistance afforded by the scales. It is stated that it cannot pass over a plate of glass, or other entirely smooth surface. We saw the experiment tried, by placing a small pane of glass in a box, in which was a common black snake. He was made to pass over it repeatedly, but evidently found that he had no foothold on it; and the third time, as he approached it, elevated the fore-part of his body slightly, and brought his head down beyond the glass, and, on passing, his body seemed scarcely to touch it. This gave an opportunity to witness the wave-like movement of the scales, that is, of their elevation,

which runs from the head to the tail, enabling the animal to move continuously, instead of by a series of minute pushes, as would occur if all the scales be lifted and depressed at once.

6. In the moulting of the snake, which occurs yearly, and sometimes oftener, the outer covering of these creeping scales is shed; this is true also of the covering of the eyes, so that the cast epidermis represents, with great distinctness, the external features of the animal. In moulting, the outer skin is broken along the back, near the head, and the animal emerges, frequently drawing with him the skin, turning it inside out. Prof. Owen states, however, that in one instance exuviation commenced by the snake rubbing the skin loose around its jaws, working it back against the sides of its cage, when, putting its head through coils made by its own body, it pressed back the skin, turning it outward. We have observed that the black snake, on moulting, becomes more sensitive and irritable, but shy, and inclined, for a day or so, to keep close in a corner of his cage. The scaly covering of serpents must diminish their acuteness of touch; but we have found them sensitive to exceedingly slight irritation. They are without an external ear, and the phrase "deaf as an adder" is a familiar one. Nevertheless, they have organs of audition beneath the skin or protecting membrane, and we know by experiment that snakes hear and distinguish sounds, and are said in some instances to recognize the voice of their keeper. Some species, it has been observed, are influenced by music, and we quote the statement by Chateaubriand of an incident witnessed by himself. He says: "The

Canadian began to play upon his flute. The snake (a rattlesnake) drew its head backward, its eyes lost their sharpness, the vibrations of its tail relaxed, and, turning its head toward the musician, remained in an attitude of pleased attention."

7. The snake-charmers familiar to travelers in Eastern countries, handle cobras with apparent impunity, cause them to advance or retreat, to coil and uncoil, to bow their heads, or bring their deadly mouths to their own by musical sounds, either vocal or instrumental. A story is related of an English gentleman, residing in a mountainous part of India, who was compelled to desist playing upon a flute because the music attracted serpents to his residence. The sense of taste in serpents must be very feeble, as it is quite unserviceable. They swallow their food whole, nor have they any teeth by which mastication can be accomplished. Their sense of smell is also obtuse. The organs by which this is effected are near the muzzle, but, according to Cuvier, they are without the sinuses which exist in the heads of mammals. We have tested this sense in several species of snakes, but only pungent odors seem to specially annoy them. The tongue of the serpent is a harmless appendage, tough, horny, and double-pointed; and, like the same member in man, has a wonderful propensity to be in motion. That snakes sting with their tongues is an old but erroneous opinion. Perhaps our own species is not equally innocent in that respect. All serpents are carnivorous, and nearly all seize and swallow living food. Their teeth are bony, hard, conical in shape, and exceedingly sharp-pointed. None of the class

have grinding or cutting teeth. They are formed for holding their food, not to grind, crush, or cut it. Moreover, all their teeth are recurved in form and position; that is, they point in or backward, so that an object once seized can scarcely escape, and, if the jaws be fully distended, could only with great difficulty be ejected. Instances are given where serpents have died from their inability to swallow what they could not eject from their throats, and it is obvious that life could not continue a very long time under such circumstances, for, as Prof. Owen observes, "while swallowing, the tracheæ may be so compressed that no air can pass, and their only resource is what is contained in the lungs."

8. We have observed that serpents swallow their food whole. They make a meal from a mouthful, but the mouthful is sometimes a very large one, for they will swallow animals twice or thrice their own diameter. This is permitted by the extraordinary expansibility of their body; but the enlargement of their jaws is a complicated phenomenon. In the act of swallowing, they yield at every point, sideways as well as vertically. The elastic integuments which hold the parts of their jaws in place give way, and the apparently small mouth becomes an enormous one. Digestion proceeds slowly, and, if the meal be excessive, as it often is, the serpent remains sluggish and comparatively helpless a long time. "They have been kept four, six, and eight months, without being fed, and with very little apparent waste of substance." Bruce reports that he kept specimens of the *cerastes*, or horned-snake, two years in a glass vessel without

food, during which time they cast their skins as usual.

9. Hibernation is with them a period of profound torpor. In our temperate climates they gather in large numbers, in some hole, or burrow in the ground, or in clefts of rocks, for their winter sleep. We once saw twenty-six black snakes taken from one burrow beneath the roots of a partially-fallen tree, in February. Other observers have found a much larger number. We are informed that more than three hundred have been found in a single burrowing-place, and that many species, venomous and non-venomous, sometimes resort to the same rendezvous and hibernate together. In the tropics the anaconda, and perhaps other species of serpents, sometimes hibernate during the dry season of summer in the hardened mud of dried-up pools. It is by the power to hibernate that serpents survive during the winters of temperate climates, but they seem unable to withstand the extreme and long-continued cold of the Arctic zone. There, serpents, and indeed reptiles of all kinds, are rare, and frequently are entirely wanting. In the Falkland Islands, Terra del Fuego, and the mountains of Southern Patagonia, no serpents have been found. The persistence of vitality in serpents is extraordinary, and continues after great mutilations. They are said to have lived several days after the removal of the head and viscera. One placed in a vacuum twenty-four hours still showed signs of sensibility; and, many hours after decapitation, a rattlesnake would plunge its headless trunk as in the usual act of striking.

ELIAS LEWIS, "The Popular Science Monthly."

THE KING OF BIRDS.

1. In the African plains and wildernesses, where the lion seeks his prey, where the pachyderms make the earth tremble under their weighty strides, where the giraffe plucks the high branches of the acacia, and the herds of the antelope bound along: there also dwells the Ostrich, the king of birds, if size alone gives right to so proud a title; for neither the condor nor the albatross can be compared in this respect to the ostrich, who raises his head seven or eight feet above the ground, and attains a weight of from two to three hundred pounds. His small and weak wings are incapable of carrying him through the air, but their flapping materially assists the action of his legs, and serves to increase his swiftness when, flying over the plain, he "scorns the horse and its rider." His feet appear hardly to touch the ground, and the length between each stride is not infrequently from twelve to fourteen feet, so that for a time he might even outstrip a locomotive rushing along at full speed.

2. In Senegal, Adanson saw a couple of ostriches so tame that two negro boys could sit upon the largest of them. "Scarce had he felt the weight," says the naturalist, "when he began to run with all his might, and thus they rode upon him several times around the village. I was so much amused with the sight, that I wished to see it repeated; and in order to ascertain how far the strength of the birds would reach, I ordered two full-grown negroes to mount upon the

smallest of them and two others upon the strongest. At first they ran in a short gallop with very small strides, but after a short time they extended their wings like sails, and scampered away with such an amazing velocity that they scarcely seemed to touch the ground. Whoever has seen a partridge run knows that no man is able to keep up with him, and were he able to make greater strides his rapidity would undoubtedly be still greater. The ostrich, who runs like a partridge, possesses this advantage, and I am convinced that these two birds would have distanced the best English horses. To be sure they would not have been able to run for so long a time, but in running a race to a moderate distance they would certainly have gained the prize."

3. Not only by his speed is the ostrich able to baffle many an enemy, but the strength of his legs also serves him as an excellent means of defense; and many a panther or wild dog coming within reach of his foot has had reason to repent of its temerity. But in spite of the rapidity of his flight, during which he frequently flings large stones backward with his foot, and in spite of his strength, he is frequently obliged to succumb to man, who knows how to hunt him in various ways.

4. Unsuspicious of evil, a troop of ostriches wanders through the plain, the monotony of which is only relieved here and there by a clump of palms, a patch of candelabra-shaped tree-euphorbias, or a vast and solitary baobab. Some leisurely feed on the sprouts of the acacias, or the hard leaves of the mimosas, others agitate their wings and ventilate the delicate

plumage, the possession of which is soon to prove so fatal to them. No other bird is seen in their company —for no other bird leads a life like theirs; but the zebra and the antelope are fond of associating with the ostrich, desirous perhaps of benefiting by the sharpness of his eye, which is capable of discerning danger at the utmost verge of the horizon. But in spite of its vigilance, misfortunes are already gathering round the troop, for the Bedouin has spied them out, and encircles them with a ring of his fleetest coursers. In vain the ostrich seeks to escape. One rider drives him along to the next, the circle gradually grows narrower and narrower, and, finally, the exhausted bird sinks upon the ground, and receives the death-blow with stoical resignation.

5. To surprise the cautious seal the northern Eskimo puts on a skin of the animal, and imitating its motions mixes among the unsuspicious herd; and, in South Africa, we find the Bushman resorts to a similar stratagem to outwit the ostrich. He forms a kind of saddle-shaped cushion, and covers it over with feathers, so as to resemble the bird. The head and neck of an ostrich are stuffed, and a small rod introduced. Preparing for the chase, he whitens his black legs with any substance he can procure, places the saddle on his shoulders, takes the bottom part of the neck in his right hand, and his bow and poisoned arrows in his left. Under this mask he mimics the ostrich to perfection, picks away at the verdure, turns his head as if keeping a sharp lookout, shakes his feathers, now walks, and then trots, till he gets within bow-shot, and when the flock runs, from one receiving an arrow, he

runs too. Sometimes, however, it happens that some wary old bird suspects the cheat, and endeavors to get near the intruder, who then tries to get out of the way, and to prevent the bird from catching his scent, which would at once break the spell.

6. The ostrich generally passes for a very stupid animal, yet to protect its young it has recourse to the same stratagems which we admire in the plover, the oyster-catcher, and several other strand-birds. Thus Professor Thunberg relates that riding past a place where a hen-ostrich sat on her nest, the bird sprang up and pursued him, in order to draw off his attention from her young ones or her eggs. Every time the traveler turned his horse toward her, she retreated ten or twelve paces, but as soon as he rode on, pursued him again.

7. The instinct of the ostrich in providing food for its young is no less remarkable, for it is now proved that this bird, far from leaving its eggs, like a cold-blooded reptile, to be vivified by the sun, as was formerly supposed, not only hatches them with the greatest care, but even reserves a certain portion of eggs to provide the young with nourishment when they first burst into life: a wonderful provision, when we consider how difficult it would be for the brood to find any other adequate food in its sterile haunts. In Senegal, where the heat is extreme, the ostrich, it is said, sits at night only upon those eggs which are to be rendered fertile, but in extratropical Africa, where the sun has less power, the mother remains constant in her attentions to the eggs both day and night. The number of eggs which the ostrich usually sits upon is

ten; but the Hottentots, who are very fond of them, upon discovering a nest, seize fitting opportunities to remove one or two at a time; this induces the bird to deposit more, and in this manner she has been known, like the domestic hen, to lay between forty and fifty in a season.

8. Almost as soon as the chicks of the ostrich (which are about the size of pullets) have escaped from the shell, they are able to walk about and to follow the mother, on whom they are dependant for a long time. And here again we find a wonderful provision of nature in providing the young of the ostrich with a color and a covering admirably suited to the localities they frequent. The color is a kind of pepper and salt, agreeing well with the sand and gravel of the plains, which they are in the habit of traversing, so that you have the greatest difficulty in discerning the chicks even when crouching under your very eyes. The covering is neither down nor feathers, but a kind of prickly stubble, which no doubt is an excellent protection against injury from the gravel and the stunted vegetation among which they dwell.

9. The ostrich resembles in many respects the quadrupeds, and particularly the camel, so that it may almost be said to fill up the chasm which separates the mammalia from the birds, and to form a connecting link between them. Both the ostrich and the dromedary have warty excrescences on the breast upon which they lean while reposing, an almost similarly formed foot, the same muscular neck; and when we consider that they both feed upon the most stunted herbage, and are capable of supporting thirst for an

incredibly long time, being, in fact, both equally well formed for living on the arid plains, it is certainly not to be wondered at that the ancients gave the ostrich a name betokening this similitude (*Struthio camelus*), and that the fancy of the Arabs ascribes its original parentage to a bird and to a dromedary.

10. It is difficult to ascertain what the tastes of the ostrich may be while roaming the desert, but when in captivity no other bird or animal shows less nicety in the choice of its food, as it swallows with avidity stones, pieces of wood and iron, spoons, knives, and other articles of equally *light* digestion that may be presented to it. "Nothing," says Methuen, speaking of a domesticated ostrich, "disturbed its digestion—dyspepsia (happy thing) was undreamt of in its philosophy. One day a Muscovy-duck brought a promising race of ducklings into the world, and with maternal pride conducted them forth into the yard. Up with solemn and measured stride walked the ostrich, and, wearing the most mild and benignant cast of face, swallowed them all, one after the other, like so many oysters, regarding the indignant hissings and bristling plumage of the hapless mother with stoical indifference."

11. The costly white plumes of the ostrich, which are chiefly obtained from the wings, have been prized in all ages for the elegance of their long, waving, loose, and flexible barbs. From seventy to ninety feathers go to the pound; but a single bird seldom furnishes more than a dozen, as many of them are spoilt by trailing or some other accident. The vagrant tribes of the Sahara sell their ostrich plumes to the caravans

which annually cross the desert, and convey them to the ports of the Mediterranean. Here they were purchased as far back as the twelfth or thirteenth century, by the Pisanese or Genoese merchants, through whose agency they ultimately crossed the Alps to decorate the stately Burggräfinnen of the Rhine, or the wives of the opulent traders of Augsburg or Nuremburg. At a still more remote period the Phœnicians brought ostrich-feathers from Ophir to Tyre, whence they were distributed among the princes of the Eastern world.

12. In Algeria, the ostrich is often domesticated, particularly on account of its eggs, which weigh three pounds, and are equivalent to twenty-four of the common fowl's eggs. According to Andersson they afford an excellent repast; while Dr. Livingstone tells us they have a strong disagreeable flavor, which only the keen appetite of the desert can reconcile one to. The flesh of the ostrich is decidedly coarse, but as there is no accounting for tastes, the Romans seem to have prized it; and Firmus, one of their pseudo-emperors, most likely desirous of emulating the gormandizing powers of the bird on which he fed, is said to have devoured a whole ostrich at *one* meal.

13. A legend of the Arabs gives the following poetical account of the origin of the crippled wings and ruffled coat of the ostrich. "About a thousand years ago," say the wandering tribes of Kordofan, "the ostrich still resembled the Hubahra or Arabian bustard, and both together inhabited the grassy plains. Then also he flew remarkably well, nor was he so shy as at present, when he avoids the approach of man

with gigantic strides, but lived in friendship and confidence both with him and the other animals of the desert. One day the Hubahra thus addressed him: 'Dear brother! if thou art inclined we will, inschalla! (with God's permission) fly to-morrow to the river, bathe, drink, and then return to our young!' 'Well,' replied the ostrich; 'we will do so:' but he did not add—'inschalla!' for he was arrogant, and did not bow before the might of the all-merciful and eternal God, 'whose praise the angels in heaven proclaim, and whose glory the thunder in the clouds celebrates,' as hitherto he had only known His inexhaustible goodness, and prided himself upon his own strength and his strong wings.

14. "On the following morning they prepared for their journey, but the Hubahra before starting said, 'Be issm lillahi!' (in the name of Allah) while the ostrich remained mute, and then they both flew toward the eye of God (the sun). And the ostrich rose higher and higher, and striking the air with his mighty wings left the Hubahra far behind. His heart was full of arrogance; he forgot the blessing of Him who is the fountain of all blessings, and relied only upon himself. But the measure of God's mercy was filled to overflowing, and the anger of Allah was roused against the offender. Higher and higher he rose, as if he wanted to reach the sun. But now the avenging angel of the Lord approached, and withdrew the veil which separated him from the flaming orb. In an instant his wings were burnt, and he fell miserably down upon the earth. Even now he cannot fly; even now thou seest his singed feathers; even now he

fears God's vengeance, and endeavors to escape it with gigantic strides. Therefore, O man! let the bird of the desert serve thee as a warning example: humble thyself before the power of the Almighty, and never undertake anything without saying beforehand 'inschalla!' that the blessing of God may attend thy work." There is evidently a great resemblance between this legend and the story of Icarus, but the Arab tale gives an excellent moral lesson, and is imbued with a deep religious feeling, of which we find no traces in the Greek.

G. HARTWIG, "The Tropical World."

THE CHAMELEON.

1. AMONG the tree lizards, or those which rarely crawl on the ground and never enter the water, the chameleon is the most noticeable. This singular reptile has long been famous for its power of changing its color, a property, however, which has been greatly exaggerated. Although all lizards are torpid, some of them are quite capable of great activity at certain seasons, but the chameleon is sluggish in the extreme, being the very sloth among reptiles. When it moves along the branch on which it is clinging the reptile first raises one foot very slowly indeed, and will sometimes remain with its foot in air for a considerable time, as if it had gone to sleep in the interim. It then puts the foot slowly forward, and takes a good grasp

of the branch. Having satisfied itself that it is firmly secured, it leisurely unwinds its tail, which has been tightly twisted around the branch, shifts it a little forward, coils it around again, and then rests for a while. With the same slow precaution each foot is lifted forward and advanced, the movement being only a little faster than the hour hand of a watch.

2. The chameleon's food consists of insects, mostly of flies, and, like many other reptiles, it is able to go for months without food, a fact which gave rise to the belief that the chameleon lived on the air. To judge by externals, there never was an animal less fitted than the chameleon for capturing anything as active as a fly, and yet we shall see that the lizard is well equipped for this purpose. The tongue is the instrument by which the fly is captured, being first deliberately aimed like a billiard-player directing a stroke of his cue, and then darted out with singular velocity. This member is very muscular, and is furnished at the tip with a kind of viscid secretion which causes the fly to adhere to it. Its mouth is well furnished with teeth, which are set firmly into its jaw, and enable it to bruise the insects after getting them into its mouth by means of the tongue.

3. The eyes have a most singular appearance, and are worked quite independently of each other, one rolling backward, while the other is directed forward or upward. There is not the least spark of expression in the eye of the chameleon, which looks about as intellectual as a green pea with a dot of ink upon it.

4. In speaking of the changes of color in the chameleon, Mr. Wood, the writer on natural history,

Chameleons.

says: "I kept a chameleon for a long time, and carefully watched its changes of color. Its primary hue was gray-black, but other colors were constantly passing over its body. Sometimes it would be striped like a zebra with light yellow, or covered with circular yellow spots. Sometimes it was all chestnut and black like a leopard, and sometimes it was brilliant green. Sometimes it would be gray, covered with black spots; and once, when it was sitting on a branch, it took the hue of the autumnal leaves so exactly that it could scarcely be distinguished from them."

5. Let us now watch a chameleon on the outlook for food. Clinging securely to one or more twigs by means of its claw-like feet and prehensile tail, it awaits its prey with a patience and perseverence as well as a mute immobility that might well be imitated by holiday sportsmen and fishing amateurs. It remains petrified in the same spot for hours, as if it were of cast iron in a mold. But its large eyes, which are covered over to the dimensions of a very small shining speck with hard lids, are incessantly turning in every direction to catch a glimpse of passing prey. One of these eyes looks forward and downward, the other upward and backward, turning incessantly about. At last a grasshopper or a fly settles near by. One of the rolling eyes instantly notes the fact, and now the chameleon opens his mouth just enough to let the tip of his thick, cylindrical tongue be seen. In another moment out leaps the wonderful tongue missile with unerring certainty, and swift as an arrow, and the captured booty is in the lizard's mouth. If the post chosen is fruitful in game, the chameleon will not stir for

hours. But if it yields only little the creature overcomes its laziness and starts out a-hunting. Our predatory marksman will now display, perhaps, the most surprising agility and suppleness. Not only does it use the clawed feet but the flexible tail, and the monkey itself could not be more lithe and active in its motions.

ANONYMOUS, "A World of Wonders."

TO AN INSECT.

1. I LOVE to hear thine earnest voice,
   Wherever thou art hid,
   Thou testy little dogmatist,
   Thou pretty Katydid!
   Thou mindest me of gentlefolks,—
   Old gentlefolks are they,—
   Thou say'st an undisputed thing
   In such a solemn way.

2. Thou art a female, Katydid!
   I know it by the trill
   That quivers through thy piercing notes,
   So petulant and shrill.
   I think there is a knot of you
   Beneath the hollow tree,—
   A knot of spinster Katydids,—
   Do Katydids drink tea?

3. O, tell me where did Katy live,
And what did Katy do?
And was she very fair and young,
And yet so wicked too?
Did Katy love a naughty man,
Or kiss more cheeks than one?
I warrant Katy did no more
Than many a Kate has done.

OLIVER WENDELL HOLMES.

THE HIPPOPOTAMUS.

1. "BEHOLD now Behemoth, which I made with thee; he eateth grass as an ox; his bones are as strong pieces of brass; his bones are like bars of iron; he lieth under the shady trees, in the covert of the reeds and fens. The shady trees cover him with their shadow; the willows of the brook compass him about. Behold he drinketh up a river: he trusteth that he can draw up Jordan into his mouth." Thus, in the book of Job, we find the Hippopotamus portrayed with few words but incomparable power.

2. According to the inspired poet, this huge animal seems anciently to have inhabited the waters of Palestine, but now it is nowhere to be found in Asia; and even in Africa the limits of its domain are perpetually contracting before the persecutions of man. It has entirely disappeared from Egypt and Cape Colony, where Le Vaillant found it in numbers during the last century. In many respects a valuable prize;

of easy destruction, in spite, or rather on account of its size, which betrays it to the attacks of its enemies; a dangerous neighbor to plantations, it is condemned to retreat before the waves of advancing civilization, and would long since have been extirpated in all Africa, if the lakes and rivers of the interior of that vast den of barbarism were as busily plowed over as ours by boats and ships, or their banks as thickly strewn with towns and villages.

3. For the hippopotamus is not able, like so many other beasts of the wilderness, to hide itself in the gloom of impenetrable forests, or to plunge into the sandy desert; it requires the neighborhood of the stream, the empire of which it divides with its amphibious neighbor the crocodile. Occasionally during the day it is to be seen basking on the shore amid ooze and mud, but throughout the night the unwieldy monster may be heard snorting and blowing during its aquatic gambols; it then sallies forth from its reed-grown coverts to graze by the light of the moon, never, however, venturing to any distance from the river, the stronghold to which it retreats on the smallest alarm. It feeds on grass alone, and when there is any danger only at night. Its enormous lips act like a mowing machine, and form a path of short cropped grass as it goes on eating.

4. In point of ugliness the hippopotamus might compete with the rhinoceros itself. Its shapeless carcass rests upon short and disproportioned legs, and, with its vast belly almost trailing upon the ground, it may not inaptly be likened to an overgrown "prize-pig." Its immensely large head has each jaw armed

with two formidable tusks, those in the lower, which are always the largest, attaining at times two feet in length; and the inside of the mouth resembles a mass of butcher's meat. The eyes, which are placed in prominences like the garret windows of a Dutch house, the nostrils, and ears, are all on the same plane, on the upper level of the head, so that the unwieldy monster, when immersed in its favorite element, is able to draw breath, and to use three senses at once for hours together, without exposing more than its snout. The hide, which is upward of an inch and a half in thickness, and of a pinkish-brown color, clouded and freckled with a darker tint, is destitute of covering, excepting a few scattered hairs on the muzzle, the edges of the ears and tail. Though generally mild and inoffensive, it is not to be wondered at that a creature like this, which when full-grown attains a length of eleven or twelve feet, and nearly the same colossal girth, affords a truly appalling spectacle when enraged, and that a nervous person may well lose his presence of mind when suddenly brought into contact with the gaping monster. Even Andersson, a man accustomed to all sorts of wild adventure, felt rather discomposed when one night a hippopotamus, without the slightest warning, suddenly protruded its enormous head into his bivouac, so that every man started to his feet with the greatest precipitation, some of the party, in the confusion, rushing into the fire and upsetting the pots containing the evening meal.

5. As among the elephants and other animals, elderly males are sometimes expelled the herd, and, for want of company, become soured in their temper, and

so misanthropic as to attack every boat that comes near them. The "rogue-hippopotami" frequent certain localities well known to the inhabitants of the banks, and, like the outcast elephants, are extremely dangerous. Dr. Livingstone, passing a canoe which had been smashed to pieces by a blow from the hind foot of one of them, was informed by his men that, in case of a similar assault being made on his boat, the proper way was to dive to the bottom of the river, and hold on there for a few seconds, because the hippopotamus, after breaking a canoe, always looks for the people on the surface, and if he sees none, soon moves off. He saw some frightful gashes made on the legs of the people who, having had the misfortune to be attacked, were unable to dive.

6. In rivers where it is seldom disturbed, such as the Zambesi, the hippopotamus puts up its head openly to blow, and follows the traveler with an inquisitive glance, as if asking him, like the "moping owl" in the elegy, why he comes to molest its "ancient solitary reign?" but in other rivers, such as those of Londa, where it is much in danger of being shot, it takes good care to conceal its nose among water-plants, and to breathe so quietly that one would not dream of its existence in the river, except by footprints on the banks. Notwithstanding its stupid look—its prominent eyes and naked snout giving it more the appearance of a gigantic boiled calf's head than anything else—the huge creature is by no means deficient in intelligence, knows how to avoid pitfalls, and has so good a memory that, when it has once heard a ball whiz about its ears, it never after ceases to be wide-

awake at the approach of danger. Being vulnerable only behind the ear, however, or in the eye, it requires the perfection of rifle-practice to be hit; and when once in the water, is still more difficult to kill, as it dives and swims with all the ease of a walrus, its huge body being rendered buoyant by an abundance of fat. Its flesh is said to be delicious, resembling the finest young pork, and is considered as great a delicacy in Africa as a bear's paw or a bison's hump in the prairies of North America. The thick and almost inflexible hide may be dragged from the ribs in strips, like the planks from a ship's side. These serve for the manufacture of a superior description of sjambok, the elastic whip with which the Cape boer governs his team of twelve oxen or more, while proceeding on a journey. In Northern Africa it is used to chastise refractory dromedaries or servants; and the ancient Egyptians employed it largely in the manufacture of shields, helmets, and javelins.

7. But the most valuable part of the hippopotamus is its teeth (canine and incisors), which are considered greatly superior to elephant ivory, and, when perfect and weighty, will fetch as much as one guinea per pound, being chiefly used for artificial teeth, since it does not readily turn yellow. All these uses to which the hippopotamus may be applied are naturally as many prices set upon its head; and the ravages it occasions in the fields are another motive for its destruction. On the White Nile the peasantry burn a number of fires, to scare the huge animal from their plantations, where every footstep plows deep furrows into the marshy ground. At the same time,

they keep up a prodigious clamor of horns and drums, to terrify the ruinous brute, which, as may well be imagined, is by no means so great a favorite with them as with the visitors of the Zoölogical Gardens. They have besides another, and, where it succeeds, a far more efficacious method of freeing themselves from its depredations. They remark the places it most frequents, and there lay a large quantity of pease. When it comes on shore, hungry and voracious, it falls to eating what is nearest, and fills its vast stomach with the pease, which soon occasion an insupportable thirst. The river being close at hand, it immediately drinks whole buckets of water, which, by swelling the pease, cause it to blow up, like an overloaded mortar.

8. The natives on the Teoge, and other rivers that empty themselves into Lake Ngami, kill the hippopotamus with iron harpoons, attached to long lines ending with a float. A huge reed raft, capable of carrying both the hunters and their canoes, with all that is needful for the prosecution of the chase, is pushed from the shore, and afterward abandoned to the stream, which propels the unwieldy mass gently and noiselessly forward. Long before the hippopotami can be seen, they make known their presence by awful snorts and grunts while splashing and blowing in the water. On approaching the herd—for the gregarious animal likes to live in troops of from twenty-five to thirty—the most skillful and intrepid of the hunters stands prepared with the harpoons, while the rest make ready to launch the canoes should the attack prove successful. The bustle and noise caused by these preparations gradually subside: at length not

even a whisper is heard, and in breathless silence the hunters wait for the decisive conflict. The snorting and plunging become every moment more distinct; a bend in the stream still hides the animals from view; but now the point is passed, and monstrous figures, that might be mistaken for shapeless cliffs, did not ever and anon one of them plunge and reappear, are seen dispersed over the troubled waters. On glides the raft, its crew worked up to the highest pitch of excitement, and at length reaches the herd, which perfectly unconscious of danger, continue to enjoy their sports. Presently one of the animals is in immediate contact with the raft. Now is the critical moment; the foremost harpooner raises himself to his full height to give the greater force to the blow, and the next instant the iron is buried deep in the body of the bellowing hippopotamus. The wounded animal plunges violently and dives to the bottom, but all its efforts to escape are as ineffectual as those of the seal when pierced with the barbed iron of the Greenlander.

9. As soon as it is struck, one or more of the men launch a canoe from off the raft, and hastening to the shore with the harpoon line, take a round turn with it about a tree, so that the animal may either be brought up at once, or should there be too great a strain on the line, "played," like a trout or salmon by the fisherman. Sometimes both line and buoy are cast into the water, and all the canoes being launched from off the raft, chase is given to the poor brute, who whenever he comes to the surface is saluted with a shower of javelins. A long trail of blood marks his progress, his flight becomes slower and slower, his breathing

more oppressive, until at last, his strength ebbing away through fifty wounds, he floats dead on the surface.

10. But as the whale will sometimes turn upon his assailants, so also the hippopotamus not seldom makes a dash at his persecutors, and either with his tusks, or with a blow from his head, staves in or capsizes the canoe. Sometimes even, not satisfied with wrecking his vengeance on the craft, he seizes one or other of the crew, and with a single grasp of his jaws, either terribly mutilates the poor wretch or even cuts his body fairly in two.

11. The natives of Southern Africa, also resort to the ingenious but cruel plan of destroying the hippopotamus by means of a trap, consisting of a beam, four or five feet long, armed with a spear-head or hard wood spike, covered with poison, and suspended from a forked pole by a cord, which coming down to the path, is held by a catch, to be set free when the beasts tread on it. On the banks of many rivers these traps are set over every track which the animals have made in going up out of the water to graze; but the hippopotami, being wary brutes, are still very numerous. While Dr. Livingstone was on the river Shire, a hippopotamus got frightened by the ship, as she was steaming close to the banks. In its eager hurry to escape from an imaginary danger, the poor animal fell into a very real one, for rushing on shore, it ran directly under a trap, when down came the heavy beam on its back, driving the poisoned spear-head a foot deep in its flesh. In its agony, it plunged back into the river, where it soon after expired.

G. HARTWIG, "The Tropical World."

THE SPONGE.

1. Among the lowest forms of life in the world, the sponge is that which first attracts attention. This marine animal, which, as a production of nature, has been known from early antiquity, was a puzzle to the early naturalists, who could not make up their minds whether it was animal or vegetable. The curious fact was perceived that the sponge would shrink from the hand that grasped it, and that it clung to the rocks on which it was fixed with much tenacity, seeming to be endowed with an almost voluntary force. The ancient observers of nature also distinguished males from females among the sponges, but still they could not make up their minds about its exact place as animal or plant. It was not till the studies of the great Swedish naturalist Linnæus threw so much light on many previously debated questions that the sponge was finally decided to be an animal. Sponges live at the bottom of the sea, at various depths, among the clefts and crevices of rock, adhering not only to inorganic bodies but to seaweed and animals, spreading either erect or hanging, according to the body which supports them.

2. In the months of April and May sponges develop *ova*, or eggs, round, yellow, or white, from which soon proceed embryos, furnished at one end with delicate vibrating *cilia* or feelers. These are carried off by the currents, or swim around the parent sponge, seeking a place to which they may attach themselves.

They soon fix themselves to some foreign body, and become henceforth immovable, no longer giving signs of either sensibility or contractibility, while in their enlargement they are completely transformed. The substance is soon riddled with holes, and the sponge is formed. Professor Milne Edwards considers each sponge to be an individual by itself; and, as his opinions about this queer sea animal have become generally accepted, we shall briefly give his ideas. The innumerable canals by which the substance of the sponge is traversed are at once its lungs and its stomach. The water passes into the numerous little openings into the canals, and is the respiratory fluid. It traverses all the different channels, and escapes by spiral openings. The currents of water passing into the sponge not only furnish breathing fluid, but also food, and carry off the excrement. The walls of the canals offer a large absorbing surface, which separates the oxygen necessary for life, and throws off the carbonic-acid gas.

3. Some sponges form masses of a light, elastic tissue, which is at the same time resistant. The number of different species is supposed to be about four hundred, and they are found of every diversity of size and shape—in some cases three or four feet in diameter. In many cases the skeleton of sponges consists of horny or siliceous fibers, and hard mineral bodies are found in them. On buying a sponge as prepared for the market, it will be noticed that at first the substance is full of these little foreign bodies, which were brought with it up from the deep-sea bottom. At the present time sponge fishing takes place mostly in the Grecian Archipelago and the Mediterranean Sea.

Sometimes the eye will discover a hundred vessels in sight during the fishing season, which is from the first of June to the first of November. There are about a thousand fishing vessels engaged in the gathering of sponges. The operations of the fishermen may be briefly described. The inferior sponges are sought for in shallow water in the crevices of the shore rocks, from which they are detached by three-pronged harpoons. This, however, injures the sponge more or less. The finer sponge is found in deep water, and is brought up by divers, who detach the sponge from its rocky base by carefully cutting with a knife. This life is accompanied by extreme danger, as the sponge diver, like the pearl diver, is not only short-lived, in consequence of the extreme fatigue and exposure of his labors, but subject in a still more terrifying degree to the attacks of that tiger of the sea, the shark, which grows in these regions to a great size, and exhibits a corresponding ferocity. Every sponge fleet which returns with its hard-earned harvest has to report the horrible death of not a few of the wretched divers, whose laborious life is thus encompassed with double perils.

4. The Archipelago furnishes for the most part the coarser sponges, while the finer grades are found on the coast of Syria and off Barbary. In the latter region sponges of great fineness are also found of great size. Some attempts have been made to naturalize the different varieties of sponges on the coasts of France and Algeria with a fair degree of success, and this culture promises to be a profitable one in the future. The more the sponges advance toward the

north in their habitat, the finer they become, the warm tropical seas being rather favorable to the growth of the coarser species. The fine Syrian sponge is distinguished for its lightness, its flaxen color, its cup-like form, and the fineness of its texture and orifices. This is specially used for the toilet, and its price is very high. The heavy and reddish Barbary sponge is also valuable for domestic use on account of the facility with which it absorbs water and its great strength. Sponges are found in different portions of the world, but those of the Mediterranean Sea are considered the most valuable.

ANONYMOUS, "A World of Wonders."

BIRDS-OF-PARADISE.

1. THE Birds-of-Paradise are a small, but renowned family. They received their name from the idea, entertained at one time, that they inhabited the region of the Mosaic paradise. They live in a small locality in Australasia, including Papua or New Guinea, and a few adjacent islands. They are not easily tamed and kept confined; and few have been brought alive from their native locality. Mr. Beale had one at Macao, China, that had been in captivity nine years; several have been kept at Amboyna, but very few have ever been carried to Europe, although specimens of the skins and prepared birds were taken there more than three hundred years ago. Anthony Pigafetta, one of

the companions of Magellan, first imported them into Europe in 1522.

2. In form and size they somewhat resemble our crow, or blue-jay; but some are smaller. They are usually included in the tribe of cone-bills, though their bills are quite slender for that group, and a little compressed. The bills are covered at the base with downy or velvety feathers which extend over the nostrils: their wings are long and round; the tail consists of ten feathers, two of them, in some species, very long; legs and feet very long, large and strong; outer toe longer than inner, and joined to the middle one toward the base; hind-toe very long; claws long and curved. But they are chiefly remarkable for the wonderful development of various parts of their plumage, and for the metallic splendor of its rich hues. The sides of the body, and sometimes of the head, neck, breast, or tail, are ornamented with lengthened, peculiarly developed, and showy feathers. Says Wood: "In all the species, the feathers glow with resplendent radiance; in nearly all there is some strange and altogether unique arrangement of the plumage; and, in many, the feathers are modified into plumes, ribbons, and streamers, that produce the most surprising and lovely effects." The plumage of the face, breast, and throat, is usually the richest in metallic tints, while other parts frequently have very beautiful and brilliant colors.

3. Their food consists of grasshoppers, butterflies, moths, and other insects; figs, the berries of various trees and shrubs; seeds, rice, and other kinds of grain. During the heat of the day they remain concealed in

the woods, but, in the morning and evening, come forth to seek their food. Furious storms frequently bring them to the ground, when they are easily taken by the natives, who also shoot them with blunt arrows, or take them with a noose, likewise with bird-lime, or other glutinous substance, placed on the branches which they frequent. They sometimes stupefy them with *cocculus indicus*. Europeans shoot them with shot-guns. The natives formerly skinned the birds, cut off the legs and wings, and dried the skin on a stick. Later they took out the interior organs of the bird, cut off the legs, and smoked the birds with sulphur, or seared them inside with a hot iron; and, after being thoroughly dried, they put them in the hollow of a bamboo, to secure the plumage from injury. They are used by the natives, the Japanese, Chinese, East Indians, and Persians, for adorning the turbans of the men, the head-dresses of the women, and for various other purposes of ornament. The Chinese make imitations of these birds from the feathers of parrots and paroquets, to sell to strangers. The feathers were formerly, and are still, used very much as ostrich-feathers are. By their lightness and luster, they are extremely well suited for the ornaments of dress, and are very highly prized. In Europe and America, at the present time, they are sought for with avidity, to adorn ladies' hats, etc. The birds and feathers for the European market are principally obtained at Batavia and Singapore, whither the natives of Celebes, and others, bring them from Papua and the Arroo Islands. In India they derive much of their value from the miraculous virtues which the priests have ascribed to

them, causing the creature that produced them to receive the title "Bird of God," Manuco-Dewata; from which Buffon coined the modern French name, Manucode. Dr. Forster suggests, but perhaps without reason, that this bird may have been the phœnix of antiquity.

4. During the dry weather of the northwestern monsoon, in our autumn and winter, many of the birds leave Papua and go west to the Arroo group; but, upon the commencement of the wet weather of the southeastern monsoon, in our spring, they immediately return to Papua. They usually fly, on these occasions, in flocks of thirty or forty, with a reputed leader. Their moulting-time is from May to August, during the southeastern monsoon. On account of the difficulty of managing their enormously-lengthened gossamer-like plumage, they usually face the wind, whether flying or sitting. In proceeding from one place to another, they are often distressed by sudden shiftings of the wind; and, being unable to proceed in their flight against it, or go with safety before it, they are sometimes thrown to the ground. In tempestuous weather they seek the most sheltered retreats of the thickest woods. Although very active and sprightly, they are exceedingly shy and retiring in their habits. The false ideas that they were footless, lived ever on the wing, or occasionally rested suspended by the tail; fed on the dew; reared their young on the shoulders of the male, and came from the terrestrial paradise, have all had their day, but are too absurd to be more than alluded to now.

5. The Greater Paradise-Bird (*Paradisea apoda*),

frequently called the Emerald Bird of Paradise, is smaller than the crow. Linnæus gave the specific name "apoda" to this bird, which was generally and erroneously called footless, to designate the species, not to perpetuate the error. This bird seeks the thickest foliage of the loftiest trees, in which to remain concealed during the day. The feathers on the head, throat, and neck, are very short and dense. Those round the base of the bill, and on the face, are velvety and black, changing their color to green, as the direction of the light changes; those on the throat, the front half of the neck, and the upper part of the breast, are of a bright, deep, emerald green; those on the head, back of the neck, and the shoulders, are of a light, golden yellow. The eye is at the common point between these colors. If lines were drawn from it to the throat, to the forehead, and down the sides of the neck, and curved to a point on the breast, they would indicate very well the limits of the colors. The back, wings, tail, and belly, are of a bright, reddish chestnut, the breast being a little darker, and inclining to purple. From each side beneath the wings proceed a large number of long, floating, graceful plumes, some eighteen inches in length, of exceeding delicacy of texture and appearance. These extend far beyond the tail-feathers, which are about six inches long, and "their translucent golden-white veinlets produce a most superb effect, as they cross and recross each other, forming every imaginable shade of white, gold, and orange, and then deepening toward their extremities into a soft, purplish red." From the upper part of the tail proceed two black shafts or filaments, some

eighteen inches long, appearing like small wires, about one-sixteenth of an inch in diameter. The female has no floating plumes, no gem-like feathers, and no brilliant colors. The head is dark-brown; the neck, light-brown; the upper parts of the body, wings, and tail, reddish chestnut; the breast and belly, white.

6. In Bennett's "Wanderings" is an interesting description of Mr. Beale's bird, at Macao. The writer says: "This elegant creature has a light, playful, and graceful manner, with an arch and impudent look; dances about when a visitor approaches the cage, and seems delighted at being made an object of admiration. Its notes are very peculiar, resembling the cawing of a raven; but its tones are, by far, more varied. It washes itself regularly, twice daily, and, after having performed its ablutions, throws its delicate feathers up, nearly over the head, the quills of which feathers have a peculiar structure, so as to enable the bird to effect this object. Its food, during confinement, is boiled rice, mixed up with soft eggs, together with plantains, and living insects of the grasshopper tribe; these insects, when thrown to him, the bird contrives to catch in his beak with great celerity; but, if, through failure to catch them, they should fall to the floor, he will not descend to them, appearing to be fearful that, in so doing, he would soil his delicate plumage; he will eat insects in a living state, but will not touch them when dead. One of the best opportunities of seeing this splendid bird, in all its beauty of actions, as well as display of plumage, is early in the morning, when he makes his toilet; the beautiful subalar plumage is then thrown out and cleaned from any

spot that may sully its purity, by being passed gently through the bill; the short, chocolate-colored wings are extended to the utmost, and he keeps them in a steady, flapping motion, as if in imitation of their use in flight, at the same time raising up the delicate, long feathers over the back, which are spread in a chaste and elegant manner, floating like films in the ambient air. In this position the bird would remain for a short time, seemingly proud of its heavenly beauty, and in raptures of delight with its most enchanting self; it will then assume various attitudes, so as to regard its plumage in every direction. Having completed its toilet, it utters the usual cawing notes, at the same time looking archly at the spectators, as if ready to receive all the admiration that it considers its elegant form and display of plumage demand. It then takes exercise by hopping in a rapid but graceful manner from one end of the upper perch to the other, and descends suddenly upon the second perch, close to the bars of the cage, looking out for the grasshoppers, which it is accustomed to receive about this time."

7. Vanity and egotism, as usually developed, are exceedingly offensive and distasteful; but when we see a delicate creature, so richly embellished, so neat and cleanly in its habits, so fastidious in its tastes, so scrupulously exact in its observances, and so winning in all its ways, as to etherealize the commonest actions, they become not only endurable, but amusing, and even enjoyable. And if a bird, in a state of hopeless captivity, exhibits such marked traits of character, acts out so truthfully the promptings of its nature, shows

A Costa Rican Owl.

so evidently its desire to please, and possesses so nice an appreciation of being admired, how perfect must be all its ways and actions, as developed in the pure, bright air, fragrant groves, and luxuriant surroundings of its native haunts!

JAMES H. PARTRIDGE, "The Popular Science Monthly."

THE OWL.

1. IN the hollow tree, in the old gray tower,
The spectral owl doth dwell;
Dull, hated, despised, in the sunshine hour,
But at dusk he's abroad and well!
Not a bird of the forest e'er mates with him;
All mock him outright by day;
But at night, when the woods grow still and dim,
The boldest will shrink away!
O, when the night falls, and roosts the fowl,
Then, then, is the reign of the hornèd owl!

2. And the owl hath a bride, who is fond and bold,
And loveth the wood's deep gloom;
And, with eyes like the shine of the moonstone cold,
She awaiteth her ghastly groom;
Not a feather she moves, not a carol she sings,
As she waits in her tree so still;
But when her heart heareth his flapping wings,
She hoots out her welcome shrill!
O, when the moon shines, and dogs do howl,
Then, then, is the joy of the hornèd owl!

3. Mourn not for the owl, nor his gloomy plight!
The owl hath his share of good:
If a prisoner he be in the broad daylight,
He is lord in the dark greenwood! .
Nor lonely the bird, nor his ghastly mate,
They are each unto each a pride;
Thrice fonder, perhaps, since a strange, dark fate
Hath rent them from all beside!
So, when the night falls, and dogs do howl,
Sing, ho! for the reign of the hornèd owl!
We know not alway
Who are kings by day,
But the king of the night is the bold brown owl!

BRYAN W. PROCTER.

MICROSCOPIC ANIMALCULES.

1. THE animalcules which comprise the microscopic world have for a long time been known by the name of *Infusoria*, but the term ought to be abandoned, as many of these creatures do not live in infusions, but, on the contrary, inhabit the sea and fresh water. It would therefore be better to substitute the names *Microzoa* and *Protozoa;* the former meaning little animals, the latter the obscure beginnings of animal organization. For a long time the anatomy of these invisible beings appeared a perfect mystery, and men despaired of ever comprehending it. Baron Gleichen, having steeped carmine in water containing

some of these animalcules, was quite astonished to see them fill themselves with coloring matter. But this important fact passed unnoticed. Buffon and Lamarck still continued to look upon them as simple little masses of animated gelatin. A French naturalist, Dujardin, reared up a complete theory on these data. According to him the tissue of the animalcule represents a sort of spongy woof, capable of hollowing itself out into accidental cavities, which admit food and expel it by means of an outlet which opens for this purpose in the surface of the body. A strange hypothesis, according to which the microzoon hollows out for itself stomachs in its own proper substance and of its own free will!

2. The difficulty is to believe that such a theory held sway in France long after the publication of Ehrenberg's magnificent work on "The Infusoria," in which the learned Prussian naturalist demonstrated, for the first time, that these creatures, notwithstanding their extreme minuteness, possess in some cases a surprisingly complicated internal organization. Their form is, as a rule, fixed, and it is quite an exception that some of them change at will, and present to the eyes of the astonished observers so many different aspects, that at the expiration of five minutes they cannot be recognized. At one moment they are globular or three-cornered; an instant after they are seen taking on the appearance of a star. Accordingly, these creatures, the forms of which elude our grasp, have received the name of *Protei*, from the enchanter of Virgil, who by his wonderful metamorphoses was enabled to escape the notice of every one. Some animal-

cules of this class surround themselves with improvised feet like living roots, the arrangement of which they are seen varying in a thousand ways. Sometimes they lengthen them out preposterously, sometimes they make them entirely disappear. They scatter them, weld them together, or entwine them like the locks of a Gorgon.

3. The microscopic world also has its extremes. There is as wide a distance between the bulk of its tiniest representative, the crepuscular monad, and that of one of its largest, the hooded Colpodos, as there is between a beetle and an elephant. Nothing is more marvelous than the organization of these invisible beings, and if attentive observations had not placed the facts beyond doubt, men might have been tempted to think that the accounts given by naturalists were pure fiction or else audacious falsehoods.

4. A single Microzoon has, so to speak, no weight; placed in the most sensitive balance it does not impart to it the slightest oscillation. The whale, on the other hand, attains a length of one hundred feet, and a weight of two hundred tons—more than the weight of an army of three thousand men; and yet, the profusion of vital apparatus in the *Microzoa* sometimes exceeds that which is seen in these large animals, and in many others. There are some which possess fifteen to twenty stomachs, or even more. In addition there is, in some *Infusoria*, a curious mechanism appended to this superabundance of organs—one of the stomachs being furnished with teeth of extreme delicacy, which can be seen through the transparent body moving and crushing the food. Notwithstanding the extreme

minuteness of these creatures, which remained unknown through so many ages, Nature has expended the most watchful care upon them. Some of them are sheltered beneath a calcareous cuirass; and in many the protecting carapace is indestructible, and of the nature of flint, being formed of silex.

5. According to Ehrenberg some of the *Infusoria* have even eyes, which at times present the appearance of flaming red pupils. If we could suppose organs of such minuteness possessing a field of vision large enough to allow these animalcules to see us with the instruments which we use to observe them, can we imagine what a terrific impression we must make upon them when they see themselves in our hands. Lastly, many of these animalcules have, in the interior of the body, large cavities which incessantly empty and fill themselves with colored fluid. These cavities represent the heart of large animals, and their fluid the blood; and this circulating system is relatively so large that it may be stated, without any exaggeration, that some microscopic beings have hearts fifty times as large and as strong in proportion as that of the horse or ox.

6. If the wonderful organic perfection of those living corpuscles surpass all our preconceived ideas, their perpetual activity affords ground for no less astonishment. The life of all animals is made up of alternate action and repose, of movement which wastes the forces, and sleep which repairs them; but the *Infusoria* are strangers to anything of the kind; their life is an emblem of incessant agitation. Ehrenberg, who observed them at all hours of the night, always

found them in movement, and accordingly concluded that they had neither rest nor sleep! Even the plant, exhausted by its life, mounting unseen through its tissues, sleeps at the close of day; the animalcule, notwithstanding its prodigious activity, does not. Struck with the fact, Owen has conjectured that this extraordinary activity might be due to the enormous development of the digestive system in the *Infusoria*, seeing that a man, a lion, or a tiger has only one stomach, an ox or a camel four or five, while invisible *Microzoa* have sometimes a hundred!

7. In proportion as science has been perfected the horizon of life has been enlarged, and a microscopic world, full of animated existence, has been revealed in every spot to which investigation has been able to reach. The polar ices, the elevated regions of the atmosphere, and the gloomy depths of ocean, are peopled with living organisms; and everywhere their prodigious concentration astonishes us as much as the infinite variety of their forms. If the beautiful discoveries of Ehrenberg did not prove the fact, who would believe that these tiny creatures, so minute as to be invisible, possess more vital resistance than the most vigorous animals? Where the severity of the climate kills the most robust of the vegetable world, where a few scattered animals pick up a precarious subsistence, the delicate organism of the *Microzoa* suffers no injury from the most terrible cold that is experienced. More than fifty species of animalcules with siliceous carapaces were discovered by Captain Sir James Ross on the rounded masses of ice which float in the Polar Seas at the seventy-eighth degree of

south latitude. Some of those which this navigator collected in the vicinity of Victoria Land, in spite of distance and storms, arrived full of vitality at Berlin.

8. In these desolate regions the depths of ocean offer to the view even more life than its surface. In the Gulf of Erebus, the plummet brought up, from a depth of more than five hundred yards, seventy-eight species of siliceous *Microzoa;* and they have been discovered at a depth of more than twelve thousand feet, where they had to support the enormous pressure of three hundred and seventy-five atmospheres—a pressure capable of bursting a cannon, but which the gelatinous body of a microscopic *infusorium* resists in some marvelous way. These living corpuscles, which swarm in the transparent regions of the ocean, abound equally in the muddy waters of our rivers and ponds, and without being aware of it we daily swallow myriads of them in the fluids we drink. If with the aid of the microscope we were to scrutinize everything that a single drop of water sometimes contains, there would be seen enough to frighten many people.

9. Every one who has sailed at night upon the sea, or passed along its shores, is acquainted with the phenomenon of phosphorescence, which for a long time puzzled the sagacity of the learned. It was attributed to very different causes, but is now known to depend upon the presence of a multitude of animals. Sometimes, when of small extent, it is caused by fish traversing the waves like a flaming arrow; at other times it is owing to the presence of the *Medusæ*, the brilliant disks of which are seen calm and motionless in the depths of the waters; or to the *Physophora*, trailing

behind them their tresses all spangled with stars like those of Berenice in the firmament. Certain mollusks, too, though enveloped in their shells, are nevertheless phosphorescent. Even Pliny remarked that the mouths of persons who had eaten Pholades were quite luminous.

10. This phenomenon, however, is most frequently seen in places where the sea is in movement; every wave then rolls with luminous foam against the prow of the ship, and the billows gleam like the starry sky. These myriads of phosphorescent particles, which make the sea sparkle, are only *Microzoa* of extreme minuteness, but of which the bulk is increased a hundred-fold by their splendor. The ocean produces these animalcules in almost every part. Each bed of it, says Humboldt, is peopled with them at depths which exceed the height of the greatest mountain chains, and under the influence of certain meteorological changes we see them rise to the surface of its watery sheet, where they form immense luminous furrows in the wake of the ships.

11. Water presents another peculiarity equally curious, and for a long time inexplicable. At times it takes on a blood-red tint, which in every age has startled and alarmed the vulgar. From the remotest times men kept asking what might be the cause of this phenomenon, which had so much of the marvelous about it, and it was only explained on some strange hypothesis or other. But since the discovery of the microscope it has been thoroughly investigated, and it has been shown that the redness of the water depends upon the presence of extremely small plants and ani-

mals, which, under the influence of certain atmospheric conditions, multiply in such abundance, that the mind only with difficulty realizes the marvelous nature of their procreation.

12. A Belgian savant, M. Morren, after collecting together nearly all that had been written on the subject of red water from the days of Moses up to our own, gives a list of twenty-two species of animals, and almost as many plants, capable of communicating this blood color.

13. When Ehrenberg planted his tent by the shore of the Red Sea, near the town of Tor, not far from Mount Sinai, he had the rare good fortune to behold this sea tinged with the blood-red color to which, from the remotest antiquity, it has owed its name. At this very time its waves deposited on the shore a gelatinous matter of a beautiful purple color, which the great Prussian naturalist recognized as being composed of a single microscopic alga, the Red Trichodesmia, the sole cause of this celebrated phenomenon.

F. A. POUCHET, "The Universe."

THE METAMORPHOSIS OF INSECTS.

1. The grand peculiarity of insects is their metamorphosis, or change of form. Almost every insect undergoes this change, there being commonly three distinct changes of being. In the first stage the insect is a crawling caterpillar or a worm. In its second stage it is wrapped up in a covering prepared for the purpose, and is in a state of sleep. During this sleep great changes are going on. When these are completed it is a winged animal, its wings being closely folded up. In due time it comes out of its prison, and spreads its wings for flight. It is now deemed to have arrived at its perfect condition.

2. In its first stage it is called a *Larva*, this being the Latin word for mask, the idea being that the insect is now not in its true state or character, but is in a masked condition, from which it will after a while come out. When it does so it is called the *Imago*, or said to be in the imago state. The insect is now the image or representative in full of its species. Its sleeping state, the one intermediate between the larva state and the imago state, is a transition one. In this the insect is changing from a crawling to a flying animal. It is now termed a *Pupa*, the Latin for baby, because it commonly appears somewhat like an infant trussed up with bandages, as has sometimes been the fashion in some nations.

3. The different larvæ of insects have the different names of maggot, grub, and caterpillar, according to

their form and appearance. The pupæ of butterflies and moths were formerly called chrysalids and aurelias, because the coverings of some of them have spots of a golden hue. The term chrysalis is often used at the present day as synonymous with pupa, and this state of the insect is called the chrysalid state.

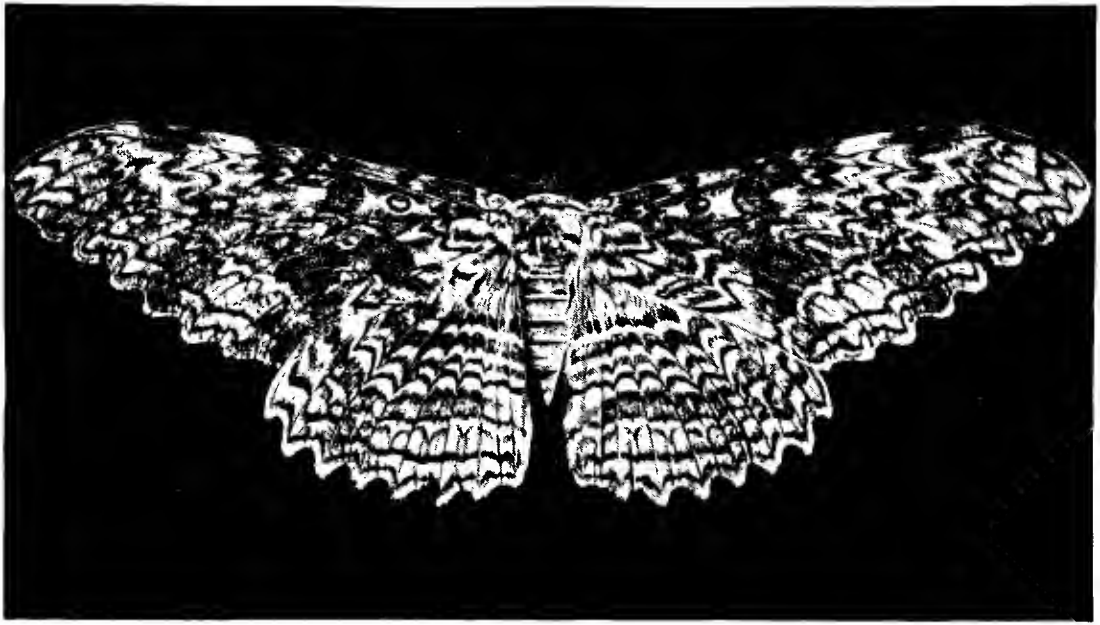
4. The changes which take place in the pupa state are very great, even radical ones. There is commonly no resemblance between the Larva and its Imago. There may be great beauty in the Imago, and none in the Larva, and sometimes the reverse is the case. Then, as to form and general structure, the contrast is of the most marked character. In the larva state it was a slow, crawling animal, but in the imago state it is light, perhaps delicate in structure, and is nimble on the wing. And the change is as great internally as it is externally. Its stomach even is changed, for its mode of getting a livelihood is different now. There are corresponding changes about the mouth, a coiled tongue perhaps appearing in place of the formidable gnawing apparatus of the larva. In relation to this change it has been well said, "Were a naturalist to announce to the world the discovery of an animal which for the first five years of its life existed in the form of a serpent; which then, penetrating into the earth, and wearing a shroud of pure silk of the finest texture, contracted itself within this covering into a body without external mouth or limbs, and resembling more than anything else an Egyptian mummy; and which, lastly, after remaining in this state for three years longer, should, at the end of that period, burst its cerements, struggle through its earthly cov-

ering, and start into day a winged bird, what would be the sensation excited by this piece of intelligence?" And yet this would be no more wonderful than the ordinary metamorphosis of insects. Indeed, many of the most marvelous circumstances in this change are not at all referred to in the supposition above made.

5. The larva is produced from an egg, and the egg is laid by the perfect insect or imago. When the larva is first hatched it is very small, but it grows with a rapidity always great, in some cases enormous. The maggots of flesh flies are said to increase in weight two hundred times in twenty-four hours. To make such an increase these animals must eat voraciously. With the great multiplication of their number, the amount which a collection of them will sometimes devour is wonderful. Linnæus calculated that three flesh flies and their immediate progeny would eat up the carcass of a horse sooner than a lion would do it.

6. In the imago state the insect eats but little, as it grows little or none ordinarily. The butterfly or moth comes forth from its prison fully grown; but the caterpillar from which it was formed was very small at the outset, and became large by large eating. Our common flies are small and delicate eaters, but the maggots, the larvæ from which they came, rioting in filth, devour largely what the flies will not touch. The great growth of larvæ obliges them to cast their skins repeatedly. The silkworm and other caterpillars cast their skins about four times during their growth.

7. Insects pass the time of their pupa state under various circumstances. Some, when about going into



A Moth Eleven Inches from Tip to Tip of Wing.

this state, crawl into some by-place away from intruders. Some work their way into the ground, and perhaps spin a silken lining for the earth-cells in which they are to sleep through their change. Some roll themselves up in leaves. Some construct for themselves a silken house, called a cocoon, attached to some leaf or twig.

8. Among those that do this last is the silkworm. The formation of the cocoon I will describe. When the worm has its silk factory, which is near its mouth, properly stocked with the gummy pulp from which the silk is to be spun, it seeks a good place where it can have a sort of scaffolding for its cocoon. It first spins some loose floss, attaching it to things around. Next it begins to wind its silk round and round, making a cocoon at length, shaped much like a pigeon's egg, being smaller at one end than the other. It thus gradually shuts itself up in a silken prison. The last of the silk which it spins is the most delicate of all, and it is well glued together, making a very smooth surface next to the silkworm's body. The silken house being constructed, it now prepares itself for its sleep and its change. It sheds its skin now for the fourth and last time, tucking its old clothes, as we may say, very snugly at one end of the cocoon. It then passes into its sleep, and a new and thin skin is formed over it, in which it gradually changes into an animal endowed with wings. At the proper time it works its way out of its prison, unfolds its wings, and flies off, not to eat mulberry leaves, as it did in the larva state, but to sip the honey from the flowers.

9. Observe the manner of its exit and the arrange-

ments for it. The head is always at the small end of the cocoon, and here the silk is less closely wound and less tightly cemented by the gluey substance. The old clothes are always at the other end, so as not to be in the way. The new coat which was formed as it entered the pupa state is easily torn, and the moth, moistening the cocoon with a fluid from its mouth at the part where it is to escape, easily forces its way through. The opening from which it emerges is very small, and the shape of the animal before it expands its wings is that of a long bundle.

10. The thread with which the worm makes its cocoon is an unbroken one. It can, therefore, be unwound or reeled off, which is done in obtaining it for manufacture. For this purpose the cocoons are exposed to the heat of an oven in order to kill the pupæ in them, and then, by a little soaking in warm water, the glutinous matter which unites the silk is so softened that the thread can be readily unwound. The length of it varies from six hundred to a thousand feet; and as it is double as spun out by the insect, its real length is nearly two thousand feet. So fine is this double thread, that the silk that comes from one cocoon does not weigh above three and a half grains, and it requires ten thousand cocoons to supply five pounds of silk. The native countries of the silkworm are China and the East Indies; and in ancient times the manufacture of silk was confined to them. So scarce was the article in other countries, even as late as James I. of England, that this monarch, before his accession to the throne, wore on some public occasion a borrowed pair of silk stockings. But at the

present time the culture of the silkworm and the manufacture of silk are so widely diffused, that silk is everywhere, in civilized communities, one of the common articles of dress.

11. When a pupa is to remain out of doors all the winter, special pains are taken to guard it against the cold. For this purpose great numbers of insects in the autumn dig their way down into the ground, and pass their pupa state in an earthy cell below the reach of frost. Some line this cell with silk, making thus a soft covering for the body, and shutting out more effectually the cold. Some of the caterpillars accomplish the same object by constructing above ground a cocoon specially adapted to guard against the cold. This is exemplified in the case of one of the largest and most splendid of our American moths —the Cecropia moth. It is found, as Professor Jaeger states, all the way from the Canadas to the Mexican Gulf, and also in all the Western States. It has large wings, measuring five to six inches from tip to tip. The scales on them are dusky brown. The borders of the wings are richly variegated, the anterior ones having near their tops a dark spot resembling an eye, and both pairs having kidney-shaped red spots. In this case the caterpillar, or larva, is nearly as beautiful in colors as the perfect insect or imago. It is of a light green color, and has coral-red warts, with short black bristles, over its body. It feeds on the leaves of trees till August or September, and then descends to seek for some currant or barberry bush upon which it may build its house for its winter sleep. "Any one," says Professor Jaeger, "who meets with these

caterpillars in the above-mentioned months may have the pleasure of witnessing their metamorphosis into cocoons, and several months after into an elegant moth, by taking them up very carefully upon leaves and carrying them home, placing them in a spacious box, with a little undisturbed earth at the bottom, and then putting into it some dry brush-wood, about one foot high, and covering the whole with gauze in order to prevent their escape."

12. I will now describe the peculiar construction of the cocoon. That of the silkworm is a simple cocoon, no special provision being made against the cold, as the pupa state, instead of lasting through the winter months, is finished in a few weeks. But in the case of the Cecropia moth there is a covering outside of the proper cocoon. This covering is fastened to a branch of some bush. It is made very strong, as its fibers are much more closely joined together than those of the cocoon inside of it. Often there are leaves attached to it, leaving the impression of their veins or nerves upon it when you have detached them. The animal evidently uses these leaves as a sort of scaffolding when it begins to construct its winter home. In spinning this covering it works all the while inside, as it does in spinning the cocoon. After finishing it, it lines it with coarse loose silk, and then proceeds to spin its cocoon in the same way that the silkworm does, making it of the same shape. The loose silk between the cocoon and the outer covering is blanketing for the purpose of warmth. By these means the pupa or chrysalis is secured against dampness and cold, and amid all the storms of winter is even more

safe from harm than an infant in its cradle under the watch of an anxious mother.

13. As in the case of the silkworm moth, the Cecropia always comes out at the smaller end, and here both the cocoon and the outer covering are made less close and strong than in the other portions. In New England this moth comes forth in June. Last year I obtained from my garden two cocoons which were near each other on a currant bush. I gave one to a lad living on Staten Island, and retained the other myself. His moth came out three weeks before mine, corresponding with the advance of the season there before ours. When mine emerged I caught the same evening in my house two others, and on the following evening three more. As we saw none before or after, this seems to show that these moths come forth almost simultaneously in the same locality.

14. Dr. Harris, in his work on the "Insects of New England," recommends a trial of the manufacture of silk from the cocoons of the Cecropia and some other of our large indigenous moths. "Their large cocoons," he says, "consisting entirely of silk, the fibers of which far surpass those of the silkworm in strength, might be employed in the formation of fabrics similar to those manufactured in India from the cocoons of the Tusseh and Arindi silkworms, the durability of which is such that a garment of Tusseh silk is scarcely worn out in the lifetime of one person, but often descends from mother to daughter; and even the covers of palanquins made of it, though exposed to the influence of the weather, last many years.

Experiments have been made with the silk of the Cecropia, which has been carded and spun, and woven into stockings that wash like linen." The silk can be very easily reeled off from the cocoons.

15. Some insects go through an imperfect metamorphosis, as the grasshoppers and locusts. They are produced from the eggs without wings, but have been formed gradually while they are in a state of activity.

WORTHINGTON HOOKER, "Natural History."

THE ARTIFICES OF ANIMALS.

1. THE deer kind are remarkable for the arts they employ in order to deceive the dogs. With this view the stag often returns twice or thrice upon his former steps. He endeavors to raise hinds or younger stags to follow him, and draw off the dogs from the immediate object of their pursuit. If he succeeds in this attempt, he then flies off with redoubled speed, or springs off at a side, and lies down on his belly to conceal himself. When in this situation, if by any means his trail is recovered by the dogs, they pursue him with more advantage, because he is now considerably fatigued. No other resource is now left him but to fly from the earth which he treads, and go into the waters, in order to cut off the scent from the dogs, when the huntsmen again endeavor to put them on his trail. After taking to the water the stag is so much exhausted that he is incapable of running much

Fallow Deer.

farther, and is soon at bay, or, in other words, turns and defends himself against the hounds. In this situation he often wounds the dogs, and even the huntsmen, by blows with the horns, till one of them cuts his hams to make him fall, and then puts a period to his life.

2. The fallow-deer are more delicate, less savage, and approach nearer to the domestic state than the stag. They associate in herds, which generally keep together. When great numbers are assembled in one park, they commonly form themselves into two distinct troops, which soon become hostile, because they are both ambitious of possessing the same part of the inclosure. Each of these troops has its own chief or leader, who always marches foremost, and he is uniformly the oldest and strongest of the herd. The others follow him; and the whole draw up in order of battle, to force the other troop, who observe the same conduct, from the best pasture. When hunted, they run not straight out, like the stag, but double, and endeavor to conceal themselves from the dogs by various artifices, and by substituting other animals in their place. When fatigued and heated, however, they take to the water, but never attempt to cross such large rivers as the stag does.

3. The roe-deer is inferior to the stag and fallow-deer, both in strength and stature; but he is endowed with more gracefulness, courage, and vivacity. His eyes are more brilliant and animated. His limbs are more nimble; his movements are quicker, and he bounds with equal vigor and agility. He is, likewise, more crafty, conceals himself with greater address,

and derives superior resources from his instincts. Though he leaves behind him a stronger scent than the stag, which increases the ardor of the dogs, he knows how to evade their pursuit, by the rapidity with which he commences his flight, and by numerous doublings. He delays not his arts of defense till his strength begins to fail him; for he no sooner perceives that the efforts of a rapid flight have been unsuccessful, than he repeatedly returns upon his former steps; and after confounding, by these opposite motions, the direction he has taken, after intermixing the present with the past emanations of his body, he, by a great bound, rises from the earth, and, retiring to a side, lies down flat upon his belly. In this immovable situation, he often allows the whole pack of his deceived enemies to pass very near him. The roe-deer differs from the stag in disposition, manners, and in almost every natural habit. Instead of associating in herds, they live in separate families. The two parents and the young go together, and never mingle with strangers. When threatened with danger, the mother hides her young in a close thicket; and so strong is her parental affection, that, in order to preserve them from destruction, she presents herself to be chased.

4. Hares form seats, or nests, on the surface of the ground, where they watch, with the most vigilant attention, the approach of any danger. In order to deceive, they conceal themselves between clods of the same color with their own hair. When pursued, they first run with rapidity, and then double or return upon their former steps. From the place of starting, the females run not so far as the males; but they double

more frequently. Hares hunted in the place where they are brought forth, seldom remove to a great distance from it, but return to their farm; and when chased two days successively, on the second day they perform the same doublings they had practiced the day before. When hares run straight out to a great distance, it is a proof that they are strangers.

5. The fox has, in all ages and nations, been celebrated for craftiness and address. Acute and circumspect, sagacious and prudent, he diversifies his conduct, and always reserves some art for unforeseen accidents. Though nimbler than the wolf, he trusts not entirely to the swiftness of his course. He knows how to insure safety by providing himself with an asylum, to which he retires when danger appears. He is not a vagabond, but lives in a settled habitation, and in a domestic state. The choice of situation, the art of making and rendering a house commodious, and of concealing the avenues which lead to it, imply a superior degree of sentiment and reflection. The fox possesses these qualities, and employs them with dexterity and advantage. He takes up his abode on the border of a wood, and in the neighborhood of cottages. Here he listens to the crowing of the cocks and the noise of the poultry. He scents them at a distance. He chooses his time with great judgment and discretion. He conceals both his route and his design. He moves forward with caution, sometimes even trailing his body, and seldom makes a fruitless expedition. When he leaps the wall, or gets in underneath it, he ravages the courtyard, puts all the fowls to death, and then retires quietly with his prey, which he either

conceals under the herbage, or carries off to his kennel. The young hares he hunts in the plains, seizes old ones in their seats, digs out the rabbits in the warrens, finds out the nests of partridges, quails, etc., seizes the mothers on the eggs, and destroys a prodigious number of game. Dogs of all kinds spontaneously hunt him. When pursued, he runs to his hole; and it is not uncommon to send in terriers to detain him till the hunters remove the earth above, and either kill or seize him alive.

6. The most certain method, however, of destroying a fox is to begin with shutting up the hole, to station a man with a gun near the entrance, and then to search about with the dogs. When they fall in with him, he immediately makes for his hole. But, when he comes up to it, he is met with a discharge from the gun. If the shot misses him, he flies off at full speed, takes a wide circuit, and returns to the hole, where he is fired upon a second time; but, when he discovers that the entrance is shut, he darts away straight forward, with the intention of never revisiting his former habitation. He is next pursued by the hounds, whom he seldom fails to fatigue; because, with much cunning, he passes through the thickest part of the forest, or places of the most difficult access, where the dogs are hardly able to follow him; and, when he takes to the plains, he runs straight out, without either stopping or doubling. But the most effectual way of destroying foxes is to lay snares baited with live pigeons, fowls, etc. The fox is an exceedingly voracious animal. Besides all kinds of flesh and fish, he devours, with equal avidity, eggs, milk, cheese, fruits,

and particularly grapes. He is so extremely fond of honey that he attacks the nests of wild bees. They at first put him to flight by numberless stings; but he retires for the sole purpose of rolling himself on the ground, and of crushing the bees. He returns to the charge so often that he obliges them to abandon the hive, which he soon uncovers, and devours both the honey and the wax.

7. Birds have such an antipathy against him that they no sooner perceive him than they send forth shrill cries to advertise their neighbors of the enemy's approach. The jays and blackbirds, in particular, follow him from tree to tree, sometimes two or three hundred paces, often repeating the watch-cries. The Count de Buffon kept two young foxes, which, when at liberty, attacked the poultry; but, after they were chained, they never attempted to touch a single fowl. A living hen was then placed near them for whole nights; and, though destitute of victuals for many hours, in spite of hunger and opportunity, they never forgot that they were chained, and gave the hen no disturbance.

8. With regard to birds, their artifices are not less numerous nor less surprising than those of quadrupeds. The eagle and hawk kinds are remarkable for the sharpness of their sight, and the arts they employ in catching their prey. Their movements are rapid or slow, according to their intentions, and the situation of the animals they wish to devour. Rapacious birds uniformly endeavor to rise higher in the air than their prey, that they may have an opportunity of darting forcibly down upon it with their

pounces. To counteract these artifices, Nature has endowed the smaller and more innocent species of birds with many arts of defense. When a hawk appears, the small birds, if they find it convenient, conceal themselves in hedges or brushwood. When deprived of this opportunity, they often, in great numbers, seem to follow the hawk, and to expose themselves unnecessarily to danger, while in fact, by their numbers, their perpetual changes of direction, and their uniform endeavors to rise above him, they perplex him to such a degree that he is unable to fix upon a single object; and, after exerting all his art and address, he is frequently obliged to relinquish the pursuit. When in the extremity of danger, and after employing every other artifice in vain, small birds have been often known to fly to men for protection. This is a plain indication that these animals, though they in general avoid the human race, are by no means so much afraid of man as of rapacious birds.

9. Of the economy of the inhabitants of the water our knowledge is rather limited. But, as the ocean exhibits a perpetual and general scene of attack and defense, the arts of assault and of evasion must, of course, be exceedingly various. For the preservation of some species of fishes, Nature has armed them with strong and sharp pikes. Others, as the perch kind, are defended by strong, bony rays in their fins. Others, as the univalve shell-fish, retire into their shells upon the approach of danger. The bivalves and multivalves, when attacked, instantly shut their shells, which, in general, is a sufficient protection to them.

Some univalves, as the limpet kind, attach themselves so firmly, by excluding the air, to rocks and stones, that, unless quickly surprised, no force inferior to that of breaking the shell can remove them. Several fishes, and particularly the salmon kind, when about to generate, leave the ocean, ascend the rivers, deposit their eggs in the sand, and, after making a proper nest for their future progeny, return to the ocean from whence they came. Others, as the herring kind, though they seldom go up rivers, assemble in myriads from all quarters, and approach the shores, or ascend arms of the sea, for the purpose of continuing the species. When that operation is performed, they leave the coasts, and disperse in the ocean, till the same instinctive impulse forces them to observe similar conduct the next season.

10. The insect tribes, though comparatively diminutive, are not deficient in artifice and address. With much art the spider spins his web. It serves him the double purpose of a habitation, and of a machine for catching his food. With incredible patience and perseverance, he lies in the center of his web for days, and sometimes for weeks, before an ill-fated fly happens to be entangled. One species of spider, which is small, of a blackish color, and frequents cottages or outhouses, I have known to live, during the whole winter months, almost without the possibility of receiving any nourishment; for, during that period, not a fly of any kind could be discovered in the apartment. If they had been in a torpid state, like some other animals, the wonder of their surviving the want of food so long would not have been so great. But

in the severest weather, and through the whole course of the winter, they were perfectly active and lively. Neither did they seem to be in the least emaciated.

WILLIAM SMELLIE. "The Philosophy of Natural History."

THE HOUSEKEEPER.

THE frugal snail, with forecast of repose,
Carries his house with him where'er he goes;
Peeps out,—and if there comes a shower of rain,
Retreats to his small domicile again.
Touch but a tip of him, a horn,—'tis well,—
He curls up in his sanctuary shell.
He's his own landlord, his own tenant; stay
Long as he will, he dreads no Quarter Day.
Himself he boards and lodges; both invites
And feasts himself; sleeps with himself o' nights.
He spares the upholsterer trouble to procure
Chattels; himself is his own furniture,
And his sole riches. Wheresoe'er he roam,—
Knock when you will,—he's sure to be at home.

CHARLES LAMB.

THE TASK OF CLASSIFICATION.

1. I WAS one day talking with Professor Owen in the Hunterian Museum, when a gentleman approached with a request to be informed respecting the nature of a curious fossil which had been dug up by one of his workmen. As he drew the fossil from a small bag, and was about to hand it for examination, Owen quietly remarked, "That is the third molar of the under jaw of an extinct species of rhinoceros." The astonishment of the gentleman at this precise and confident description of the fossil, before even it had quitted his hands, was doubtless very great. I know that mine was, until the reflection occurred that if some one, little acquainted with editions, had drawn a volume from his pocket, declaring he had found it in an old chest, any bibliophile would have been able to say at a glance, "That is an Elzevir;" or, "That is one of the Tauchnitz classics, stereotyped at Leipzig." Owen is as familiar with the aspect of the teeth of animals, living and extinct, as a student is with the aspect of editions. Yet, before that knowledge could have been acquired, before he could say thus confidently that the tooth belonged to an extinct species of rhinoceros, the united labors of thousands of diligent inquirers must have been directed to the classification of animals. How could he know that the rhinoceros was of that particular species rather than another? and what is meant by species? To trace the history of this confidence would

be to tell the long story of zoölogical investigation; a story too long for narration here, though we may pause a while to consider its difficulties.

2. To make a classical catalogue of the books in the British Museum would be a gigantic task; but imagine what that task would be if all the title-pages and other external indications were destroyed! The first attempts would necessarily be of a rough approximate kind, merely endeavoring to make a sort of provisional order amid the chaos, after which succeeding labors might introduce better and better arrangements. The books might first be grouped according to size; but, having got them together, it would soon be discovered that size was no indication of their contents: quarto poems and duodecimo histories, octavo grammars and folio dictionaries, would immediately give warning that some other arrangement was needed. Nor would it be better to separate the books according to the languages in which they were written. The presence or absence of "illustrations" would furnish no better guide, while the bindings would soon be found to follow no rule. Indeed, one by one, all the external characters would prove unsatisfactory, and the laborers would finally have to decide upon some internal characters. Having read enough of each book to ascertain whether it was poetry or prose—and, if poetry, whether dramatic, epic, lyric, or satiric; and if prose, whether history, philosophy, theology, philology, science, fiction, or essay—a rough classification could be made; but even then there would be many difficulties, such as where to place a work on the philosophy of history

—or the history of science—or theology under the guise of science—or essays on very different subjects, while some works would defy classification.

3. Gigantic as this labor would be, it would be trifling compared with the labor of classifying all the animals now living (not to mention extinct species), so that the place of any one might be securely and rapidly determined; yet the persistent zeal and sagacity of zoölogists have done for the animal kingdom what has not yet been done for the library of the Museum, although the titles of the books are not absent. It has been done by patient *reading* of the contents—by anatomical investigation of the internal structure of animals. Except on a basis of comparative anatomy, there could have been no better a classification of animals than a classification of books according to size, language, binding, etc. An unscientific Pliny might group animals according to their habitat; but when it was known that whales, though living in the water and swimming like fishes, were in reality constructed like air-breathing quadrupeds—when it was known that animals differing so widely as bees, birds, bats, and flying squirrels, or as otters, seals and cuttlefish, lived together in the same element, it became obvious that such a principle of arrangement could lead to no practical result. Nor would it suffice to class animals according to their modes of feeding, since in all classes there are samples of each mode. Equally unsatisfactory would be external form—the seal and the whale resembling fishes, the worm resembling the eel, and the eel the serpent.

4. Two things were necessary: first, that the structure of various animals should be minutely studied and described—which is equivalent to reading the books to be classified; and, secondly, that some artificial method should be devised of so arranging the immense mass of details as to enable them to be remembered, and also to enable fresh discoveries readily to find a place in the system. We may be perfectly familiar with the contents of a book, yet wholly at a loss where to place it. If we have to catalogue Hegel's "Philosophy of History," for example, it becomes a difficult question whether to place it under the rubric of philosophy, or under that of history. To decide this point, we must have some system of classification.

5. In the attempts to construct a system, naturalists are commonly said to have followed two methods, the artificial and the natural. The *artificial method* seizes some one prominent characteristic, and groups all the individuals together which agree in this one respect. In Botany the artificial method classes plants according to the organs of reproduction; but this has been found so very imperfect that it has been abandoned, and the *natural method* has been substituted, according to which the whole structure of the plant determines its place. If flying were taken as the artificial basis for the grouping of some animals, we should find insects and birds, bats and flying squirrels grouped together; but the natural method taking into consideration not one character, but all the essential characters, finds that insects, birds, and bats differ profoundly in their organization: the insect has wings,

but its wings are not formed like those of the bird, nor are those of the bird formed like those of the bat. The insect does not breathe by lungs, like the bird and the bat; and the bird, although it has many points in common with the bat, does not, like it, suckle its young; and thus we may run over the characters of each organization, and find that the three animals belong to widely different groups.

6. It is to Linnæus that we are indebted for the most ingenious and comprehensive of the many schemes invented for the cataloguing of animal forms, and modern attempts at classification are only improvements on the plan he laid down. First we may notice his admirable invention of the double names. It had been the custom to designate plants and animals according to some name common to a large group, to which was added a description more or less characteristic. An idea may be formed of the necessity of a reform by conceiving what a laborious and uncertain task it would be if our friends spoke to us of having seen a dog in the garden, and on our asking what kind of a dog, instead of their saying "a terrier, a bull-terrier, or a Skye-terrier," they were to attempt a description of the dog. Something of this kind was the labor of understanding the nature of an animal from the vague description of it given by naturalists. Linnæus rebaptized the whole animal kingdom upon one intelligible principle. He continued to employ the name common to each group, such as that of *Felis* for the cats, which became the *generic* name; and in lieu of the *description* which was given of each different kind to indicate that it was a lion, a tiger, a

leopard, or a domestic cat, he affixed a *specific* name: thus the animal bearing the description of a lion became *Felis leo;* the tiger, *Felis tigris;* the leopard, *Felis leopardus;* and our domestic friend, *Felis catus.* These double names, as Vogt remarks, are like the Christian- and sur-names by which we distinguish the various members of one family; and instead of speaking of Tomkinson with the flabby face and Tomkinson with the square forehead, we simply say John and William Tomkinson.

7. Linnæus did more than this. He not only fixed definite conceptions of species and genera, but introduced those of orders and classes. Cuvier added families to genera, and sub-kingdoms to classes. Thus a scheme was elaborated by which the whole animal kingdom was arranged in subordinate groups: the sub-kingdoms were divided into classes, the classes into orders, the orders into families, the families into genera, the genera into species, and the species into varieties. The guiding principle of anatomical resemblance determined each of these divisions. Those largest groups, which resemble each other only in having what is called the typical character in common, are brought together under the first head. Thus all the groups which agree in possessing a backbone and internal skeleton, although they differ widely in form, structure, and habitat, do nevertheless resemble each other more than they resemble the groups which have no backbone. This great division having been formed, it is seen to arrange itself in very obvious minor divisions or classes—the mammalia, birds, reptiles, and fishes. All mammals resemble each other more

than they resemble birds; all reptiles resemble each other more than they resemble fishes (in spite of the superficial resemblance between serpents and eels or lampreys). Each class, again, falls into the minor groups of orders, and on the same principles—the monkeys being obviously distinguished from rodents, and the *carnivora* from the ruminating animals; and so of the rest. In each order there are generally families, and the families fall into genera, which differ from each other only in fewer and less important characters. The genera include groups which have still fewer differences, and are called species; and these, again, include groups which have only minute and unimportant differences of color, size, and the like, and are called sub-species, or varieties.

8. Whoever looks at the immensity of the animal kingdom, and observes how intelligibly and systematically it is arranged in these various divisions, will admit that, however imperfect, the scheme is a magnificent product of human ingenuity and labor. It is not an arbitrary arrangement, like the grouping of the stars in constellations; it expresses, though obscurely, the real order of Nature. All true classification should be to forms what laws are to phenomena; the one reducing varieties to systematic order, as the other reduces phenomena to their relation of sequence. Now if it be true that the classification expresses the real order of Nature, and not simply the order which we may find convenient, there will be something more than mere resemblance indicated in the various groups; or, rather let me say, this resemblance itself is the consequence of some community in the things

compared, and will therefore be the mark of some deeper cause. What is this cause? Mr. Darwin holds that "propinquity of descent—the only known cause of the similarity of organic beings—is the bond, hidden as it is by various degrees of modification, which is partially revealed to us by our classifications"—that the characters which naturalists consider as showing true affinity between any two or more species are those which have been inherited from a common parent, and in so far all true classification is genealogical; that community of descent is the hidden bond which naturalists have been unconsciously seeking, and not some unknown plan of creation, or the enunciation of general propositions, and the mere putting together and separating objects more or less alike.

GEORGE HENRY LEWES, "Studies of Animal Life."

THE DISTRIBUTION OF ANIMALS.

1. ANIMALS are distributed over the globe according to definite laws, and with remarkable regularity. Each of the three great provinces, Earth, Air, and Water, as also every continent, contains representatives of all the classes; but the various classes are unequally represented. Every great climatal region contains some species not found elsewhere, to the exclusion of some other forms. Every grand division of the globe, whether of land or sea, each

The Kangaroo.

zone of climate and altitude, has its own fauna. And, in spite of the many cases tending to disperse animals beyond their natural limits, each country preserves its peculiar zoölogical physiognomy.

2. The space occupied by the different groups of animals is inversely as the size of the individuals. Compare the coral and elephant. Fauna now occupying a separate area is closely allied to the fauna which existed in geologic times. Thus, Australia has always been the home of Marsupials, and South America of Edentates. It is a general rule that groups of distinct species are circumscribed within definite, and often narrow, limits. Man is the only cosmopolitan; yet even he comprises several marked races, whose distribution corresponds with the great zoölogical regions. The natives of Australia are as grotesque as the animals. Certain brutes likewise have a great range: thus, the puma ranges from Canada to Patagonia; the musk-rat, from the Arctic Ocean to Florida; the ermine, from Behring Strait to the Himalayas; and the hippopotamus, from the Nile and Niger to the Orange River. Frequently species of the same genus, living side by side, are widely different, while there is a close resemblance between forms which are antipodes. The mud-eel of South Carolina and axolotl of Mexico have their connecting links in Japan and Austria. The American tapir has its mate in Sumatra; the llama is related to the camel, and the opossum to the kangaroo.

3. The chief causes modifying distribution are temperature, topography, ocean and wind currents, humidity, and light. To these may be added the

fact that animals are ever intruding on each other's spheres of existence. High mountain-ranges, wide deserts, and cold currents in the ocean are impassable barriers to the migrations of most species. Thus, river-fish on opposite sides of the Andes differ widely, and the cold Peruvian current prevents the growth of coral at the Galapagos Islands. So a broad river, like the Amazon, or a deep, narrow channel in the sea, is an effectual barrier to some tribes. Thus, Borneo belongs to the Indian region, while Celebes, though but a few miles distant, is Australian in its life. The faunæ of North America, on the east coast, west coast, and the open plains between, are very different. Animals dwelling at high elevations resemble those of colder latitudes. The same species of insects are found on Mount Washington, and in Labrador and Greenland. The range does not depend upon the powers of locomotion. The oyster extends from Halifax to Charleston, and the snapping-turtle from Canada to the equator; while many quadrupeds and birds have narrow habitats. The distribution of any group is qualified by the nature of the food. Carnivores have a wider range than herbivores. Life diminishes as we depart from the equator, north or south, and likewise as we descend or ascend from the level of the sea.

4. The zones of geography have been divided by zoölogists into narrower provinces. Five vertical regions in the sea have been recognized: the Littoral, extending between tide-marks; the Laminarian, from low water to fifteen fathoms; the Coralline, from fifteen to twenty fathoms; the deep-sea Coral, from

fifty to one hundred fathoms; and the Bathybian, from one hundred fathoms down. Every marine species has its own limits of depth. It would be quite as difficult, said Agassiz, for a fish or a mollusk to cross from the coast of Europe to the coast of America as for a reindeer to pass from the Arctic to the Antarctic regions across the torrid zone. Marine animals congregate mainly along the coasts of continents and on soundings. The meeting-place of two maritime currents of different temperatures, as on the Banks of Newfoundland, favors the development of a great diversity of fishes. Every great province of the ocean contains some representatives of all the sub-kingdoms. Deep-sea life is diversified, though comparatively sparse. Examples of all the five invertebrate divisions were found in the Bay of Biscay, at the depth of 2,435 fathoms. Distribution in the sea is influenced by the temperature and composition of the water, and the character of the bottom. The depth acts indirectly by modifying the temperature. Northern animals approach nearer to the equator in the sea than on the land, on account of cold currents. The heavy aquatic mammals, as whales, walruses, seals, and porpoises, are mainly polar.

5. Life in the polar regions is characterized by great uniformity, the species being few in number, though the number of individuals is immense. The same animals inhabit the Arctic portions of the three continents; while the Antarctic ends of the continents, Australia, Cape of Good Hope, and Cape Horn exhibit strong contrasts. Those three continental peninsulas are, zoölogically, separate worlds.

In fact, the whole southern hemisphere is peculiar. Its fauna is antique. Australia possesses a strange mixture of the old and new. South America, with newer mammals, has older reptiles; while Africa has a rich vertebrate life, with a striking uniformity in its distribution. In the tropics, diversity is the law. Life is more varied and crowded than elsewhere, and attains its highest development. The New-World fauna is old-fashioned, and inferior in rank and size, compared with those of the eastern continents.

6. As a rule, the more isolated a region, the greater the variety. Oceanic islands have comparatively few species, but a large proportion of endemic or peculiar forms. Batrachians are generally absent, and there are no indigenous terrestrial mammals. The productions are related to those of the nearest continent. When an island, as Britain, is separated from the main-land by a shallow channel, the mammalian life is the same on both sides. Protozoans, Cœlenterates, and Echinoderms are limited to the waters, and nearly all are marine. Sponges are mostly obtained from the Grecian Archipelago and the Bahamas. Corals abound throughout the Indian Ocean and Polynesia, east coast of Africa, Red Sea and Persian Gulf, West Indies and around Florida. True crinoids are found only in the Caribbean Sea and on the coast of Norway. The other Echinoderms abound in almost every sea, the star-fishes chiefly along the shore, the sea-urchins in the Laminarian zone, and the sea-slugs around coral-reefs.

7. Mollusks have a world-wide distribution over land and sea. The land forms are restricted by cli-

mate and food, the marine by shallows or depths, by cold currents, by a sandy, gravelly or mud bottom. Living Brachiopods, though few in number, occur in tropical, temperate, and Arctic seas, and from the shore to the greatest depths. The rest of the bivalves are also found on every coast and in every climate, as well as in rivers and lakes, but do not flourish at the depth of much more than two hundred fathoms. The fresh-water mussels are more numerous in the United States than in Europe, and west of the Alleghanies than east. The sea-shells along the Pacific coast of America are unlike those of the Atlantic, and are arranged in five distinct groups—Aleutian, Californian, Panamic, Peruvian, and Magellanic. On the Atlantic coast, Cape Cod and Cape Hatteras separate distinct provinces. The Old World and America have no species in common, except a few in the extreme north.

8. The limits of insects are determined by temperature and vegetation, by oceans and mountains. There is an insect-fauna for each continent, and zone, and altitude. The insects near the snow-line on the sides of mountains in the temperate region are similar to those in polar lands. The insects on our Pacific slope resemble those of Europe, while those near the Atlantic coast are more like those of Asia. Not half a dozen insects live in the sea.

9. The distribution of fishes is bounded by narrower limits than that of other animals. A few tribes may be called cosmopolitan, as the sharks and herrings; but the species are local. Size does not appear to bear any relation to latitude. The marine forms

are three times as numerous as the fresh-water. The migratory fishes of the northern hemisphere pass to a more southern region in the spring, while birds migrate in the autumn.

10. Living reptiles form but a fragment of the immense number which prevailed in the Middle Ages of Geology. Being less under the influence of man, they have not been forced from their original habitats. None are Arctic. America is the most favored spot for frogs and salamanders, and India for snakes. Australia has no batrachians, and two-thirds of its snakes are venomous. In the United States only 22 out of 176 are venomous. Frogs, snakes, and lizards occur at elevations of over 15,000 feet. Crocodiles, and most lizards and turtles, are tropical.

11. Swimming birds, which constitute about one-fourteenth of the entire class, form one-half of the whole number in Greenland. As we approach the tropics, the variety and number of land birds increase. Those of the torrid zone are noted for their brilliant plumage, and the temperate forms for their more sober hues, but sweeter voices. India and South America are the richest regions. Birds with rudimentary wings, as penguins and ostriches, prevail in the southern hemisphere. Hummers, tanagers, orioles, and toucans are restricted to the New World. Parrots are found in every continent, except Europe; and woodpeckers occur everywhere, save in Australia.

12. The vast majority of mammals are terrestrial; but cetaceans and seals take to the sea, otters and beavers delight in lakes and rivers, and moles are

The Royal Bengal Tiger.

subterranean. As of birds, the aquatic species abound in the polar regions. Marsupials inhabit two widely separated areas—America and Australia. In the latter continent, they constitute three-fourths of the fauna; while edentates, ruminants, horses, elephants, hogs, squirrels, moles, carnivores, monkeys, and apes are wanting. Excepting a few species in South Africa and South Asia, edentates are confined to tropical South America. The equine family is indigenous to South and East Africa and Southern Asia. In North America, rodents form about one-half the number of mammals; they are entirely wanting in Madagascar. Ruminants are sparingly represented in America. Carnivores flourish in every zone and continent. The prehensile-tailed monkeys are strictly South American; while the anthropoid apes belong to the west coast of Africa, and to Borneo and Sumatra. Both monkeys and apes are most abundant near the equator; in fact, their range is limited by the distribution of palms.

JAMES ORTON, "Comparative Zoölogy."

THE TIGER.

1. TIGER! Tiger! burning bright,
In the forests of the night;
What immortal hand or eye
Could frame thy fearful symmetry?

2. In what distant deeps or skies
Burned the fire of thine eyes?
On what wings dare he aspire?
What the hand dare seize the fire?

3. And what shoulder, and what art,
Could twist the sinews of thine heart?
And when thy heart began to beat,
What dread hand? and what dread feet?

4. What the hammer, what the chain?
In what furnace was thy brain?
What the anvil? what dread grasp
Dare its deadly terrors clasp?

5. When the stars threw down their spears,
And watered heaven with their tears,
Did he smile his work to see?
Did He, who made the Lamb, make thee!

6. Tiger! Tiger! burning bright,
In the forests of the night;
What immortal hand or eye
Dare frame thy fearful symmetry?

WILLIAM BLAKE.

THE END.